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Engineering News-Record

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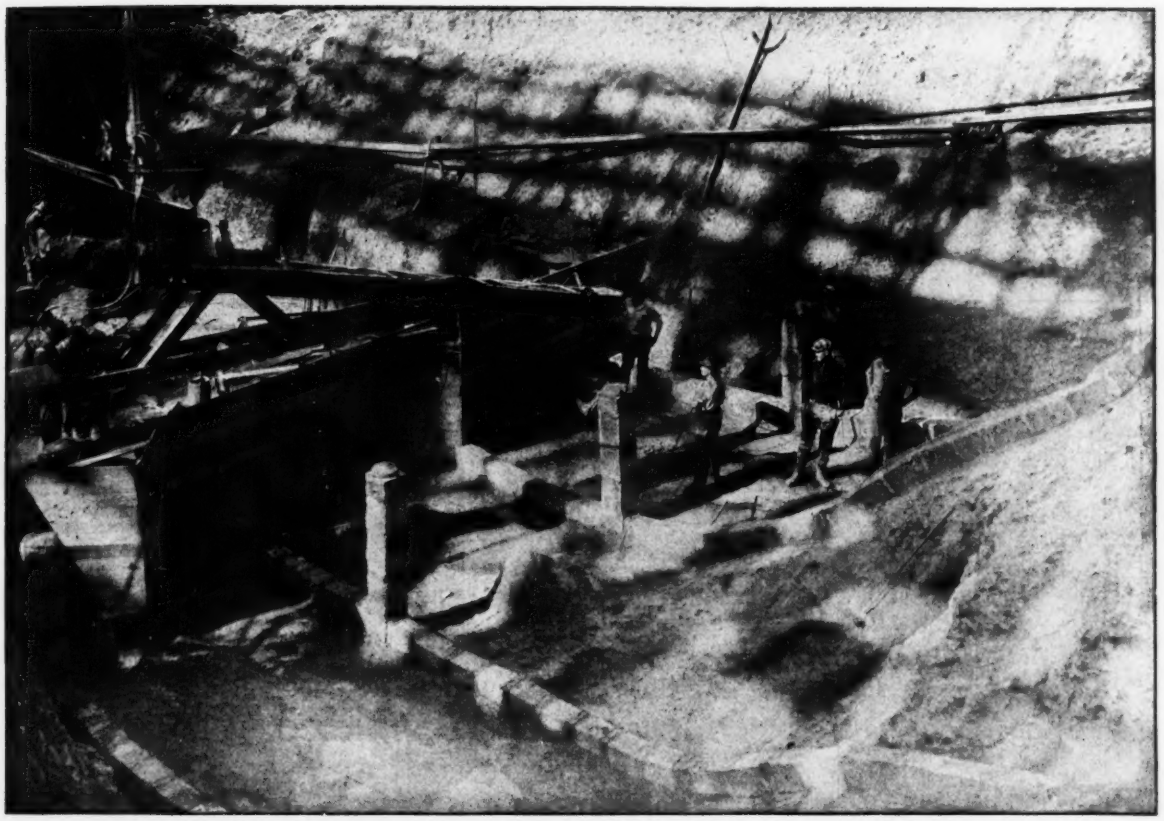

Putting Porous Concrete Tile Subdrains in Foundation of Eel River Dam in California

Concrete Dam on Eel River Built on Shale Foundation — Dam lengthened after rock slipped at abutments — entensive system of sub-drains used.

Effect of High Temperature Fire on Concrete Building — Burning napthalin fuses concrete and wrecks structure — greatest damage due to collapse of steel monitors.

Water Purification Plant at Highland Park, Michigan — Closely baffled coagulation basin permits varying detention from 20 minutes to 4 hours — perforated pipe underdrains.

Interstate Water Conflicts and the Possible Solution — A discussion by representative engineers.

Good Practice in Log-Flume Construction — *By V. K. Woods* — Sound engineering often lacking — "baby" flume and moving platform cut labor costs — novel headgates give even water flow.

Monthly Price List of Construction Materials

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ENGINEERING NEWS-RECORD

DEVOTED TO CIVIL ENGINEERING AND CONTRACTING

E. J. MEHREN *Editor*

Volume 86 — NEW YORK, MAY 5, 1921 — Number 18

Am. Soc. C. E. Harmony

HARMONY over constitutional changes prevailed last week at the Houston convention of the American Society of Civil Engineers. The armed neutrality of the January meeting had changed to a genuine effort to get together. The Houston convention did not discuss the draft as to essentials. The only change it made of its own motion was to omit a single redundant line. All other changes made were at the instance of the revision committee, the most important one—and one absolutely necessary to meet the demands of the members—having the object of restricting nominating votes for directors to members of the respective districts. The membership may, therefore, take the changes as they appear on the ballot without fear that a handful of members has upset the protracted consideration of the revision committee. As a result of the Houston decision it seems likely that the society will have a new constitution by the fall.

Technical Life Revived

IN ADDITION to the effort to get along at the Houston meeting another hopeful sign was the announcement of the authorization of committees to promote research and technical activities. Especially will the latter benefit the local sections, which have long felt the need of a common bond other than that which develops out of the interest in selecting the society's officers. The applause which greeted the news that the *Proceedings* would henceforth contain all papers and discussions also indicated the desire to restore the society to technical functioning. Hard work and service along solid lines apparently are just ahead. For this there is reason for hearty congratulation.

Log-Flume Engineering

LOG-FLUME construction has in the past been characterized by the lack of sound engineering design. The logger has depended, except in the largest operations, upon his own devices and experience to get the logs out of the woods. The building of the flume has been considered as elementary as the building of a skid road. Consequently, flumes have been built more or less rudely and logs have been floated to the mill with varying degrees of success. What the engineer may contribute to this branch of logging engineering is told in an article on p. 768 of this issue. The author shows that getting the logs to the mill involves many considerations usually neglected. Mr. Woods has reduced to a minimum the snaking of logs coming down side gulches, by carrying the flume to the timber rather than the timber to the flume. Study of operation of flumes has resulted in adopting a vertical curve that reduces clogging of the flume under certain conditions and the throwing out of logs under others. Other important observations having relation to successful operation will be found in the article in question. Not less important are the construction methods which the trained engineering mind has developed. These, while simple, are decidedly novel in character and will be much appreciated by men who have had experience in getting things done in new country.

Zig-Zag Concreting Chutes

DAM construction affords exceptional opportunity for ingenuity in the layout of concreting plants. In the Far West, particularly, where so many masonry dams have been built in the past few years, these plants have been many and varied. The one at the Scott dam on the Eel River, illustrated in this issue, is a case in point. The adoption of the paralleling trestle led to multiplied chuting, with central station hoppers feeding each of the chutes. This is fairly common, but what is not so common, although it is not unique, is the zig-zag wooden chute which connects the hopper to the lower position of the suspended steel chutes. At first glance these have somewhat the appearance of a child's sand toy, and, with their numerous acute-angled turns, would seem to be apt to clog easily. The testimony, however, is to the contrary. Dropping concrete vertically a considerable distance is a necessary operation in many kinds of construction. These zig-zag wooden chutes would seem to be well worth considering as a substitute for the not altogether satisfactory means generally adopted.

Fire Resisting Concrete Buildings

THE Edison fire in 1909 taught us many things about the fire resistance of concrete buildings; first of all that an unburnable—or at least slow burning—envelope does not prevent its contents from burning rapidly and secondarily that there are many precautions in design which serve to reduce the percentage of failure of a concrete structure subjected to severe fire. Since then several other fires have added to our knowledge and the excellent tests by the Bureau of Standards and the Fire Underwriters' Laboratories have supplied confirmatory data. The exceptionally intense fire in the Barrett company's naphthalin drying house, described on another page, is the latest addition to the record. It demonstrates again that unprotected structural steelwork is a dangerous adjunct to a concrete building, that square, rodded columns soon lose section under fire and thereby may readily reach a failing unit stress, that lightly-covered reinforcement is easily overheated and weakened and that gravel aggregate tends to spall under fire. All of these things should be taken care of in proper design and, in addition, the principles of fire protection must be applied in concrete buildings just as they are in buildings of inflammable material.

Integrity of Public Service

RECENTLY we called attention to the political situations now endangering the work of some highway departments. Here is obvious occasion for the activities of engineering societies, as was pointed out in connection with the instances at issue. Would not engineering societies be strengthened in their efforts to preserve the integrity of public engineering services if in every political campaign they would lay before the two principal parties memorials regarding the proper standards in the technical services of government. Candidates would thus learn, before election, that the engineering societies were vigilant in the defense of governmental engineering organizations. They would be less inclined to come into conflict with these engineering societies. The societies themselves would be stronger when action was demanded if they had previously made the acquaintance of officials by laying before them a strong statement of principles. If the presentation be made in person by public-affairs committee of the societies so much the better. On the "check list" of every governing body of an engineering society in this country should go this item: *"Before election.*—Send memorandum of principles governing engineering services to candidates for offices controlling such services."

Water Meters on the Grill

WATER-METER manufacturers were grilled at the Lockwood hearings in New York last week. Probably there were reports in newspapers even at far-distant points, and if the newspapers "ran true to form" they took the Lockwood evidence as complete proof that there is in New York a high-handed meter manufacturers' ring. Engineers will do well, however, to suspend judgment, for the Lockwood hearings continue to be of the *ex parte* type, as was pointed out in our discussion of the hearings on the cement industry. As a matter of fact, the water-meter hearing did not even attempt the introduction of evidence showing that the meter manufacturers used any influence, whether monetary or otherwise. Just because the New York Board of Aldermen refused to admit the Badger meter the conclusion was drawn that the meter manufacturers were responsible for the exclusion. Only four days elapsed, however, before the newspapers which, in news columns and editorials, unmercifully damned the competing meter manufacturers were with equal positiveness reporting that the exclusion of the Badger meter was due to the refusal of the Badger company to bribe the board of aldermen or certain of its members. As evidence of the injustice of not permitting cross-examination in these hearings is the statement of the star witness that his company was selling the small sized water-meters—⅝ in.—for one-third less than were his competitors. His own price actually figured to $9.67 while competing manufacturers report recent sales for various figures below $10 and some as low as $9.46. The Lockwood hearings are undoubtedly resulting in good but they are also spreading misinformation on which the public is convicting many who have not only not had a fair trial but are probably far removed from the wrong-doing that the counsel to the committee imputes to them. Eventually the cases will be cleared up, in some instances through court trials, but at present justice demands that judgment be withheld.

The New Federal-Aid Road Bill

RADICAL changes in the administration of federal-aid highway work will be made if the bill introduced in Congress this week by Representative Dowell of Iowa is enacted into law. The measure, the chief provisions of which were given on p. 738 of the news section last week, was drafted by the executive committee of the American Association of State Highway Officials and before its presentation was reviewed by the President and the Secretary of Agriculture. The document has been referred to as a golden mean between inadvisable extremes. It aims, through several far-reaching modifications of the existing federal-aid highway act, passed in 1916 and amended in 1919, to correct certain undesirable features of federal-aid work and to place the future program upon a sounder basis.

One of the chief criticisms of federal-aid work has related to the practice in some states of matching federal appropriations, not exclusively with state funds, but with county or a combination of state and county money. The result has been that great pressure has been brought to bear to select roads for political rather than traffic reasons. This has resulted in the expenditure of funds upon isolated stretches having little relation to a logical state or national system of roads.

This condition will be remedied by the passage of the new bill. It provides that within a period of two years federal government appropriations shall be matched with *state* funds. There will then be no financial backing for local interests in their efforts to secure the expenditure of federal-aid money for highways of only local importance. State highway departments will be able to select for improvement routes which are demanded by the best interests of the whole state. This will be a big step forward.

Of equal importance is the stipulation requiring the designation by each state accepting federal funds of a state highway system, with a mileage not to exceed 7 per cent of the total mileage of the state. The roads in the system would be classified into two groups: First, the primary or interstate roads, which are to comprise three-sevenths of the state system, and second, the secondary or intercounty roads constituting the remaining mileage. The designation of highway systems by the states and the classification of roads is something which the U. S. Bureau of Public Roads has been ardently advocating for some time. Up to the present, however, it has not been vested with the authority to insist upon such principles, even though their soundness has been generally recognized. With state highway systems definitely selected and recorded, and the further important provision that federal-aid shall be specifically limited to such systems, the prospect for a network of highways of interstate and intercounty importance is definitely assured. This feature of the bill should go a long way toward reconciling the national highway system advocates, who until recently failed to support—if they did not actually obstruct—the policy of federal aid.

One other admirable feature of the bill deserves emphasis—the section relating to maintenance of completed work. Briefly, federal aid will be withheld from a state unless adequate state funds for maintenance are provided, and in the event of a state's failure to maintain a project built with the aid of government funds the Secretary of Agriculture must refuse to approve any project for road construction in such state

and is also given authority to put a road in proper condition by using the state's federal-aid allotment. Drastic insistence upon proper maintenance has long been needed and this feature of the bill, if passed, will enable the government to insure satisfactory maintenance on roads which its funds have helped to build.

The bill deserves unqualified support. It represents the best thought of an organization which recognizes that the great roadbuilding program of the future must be carried out on a sound economic basis. Under the existing law certain unsatisfactory practices could not be corrected. The new bill, giving increased control to the federal authorities, puts teeth in the original act and will insure the selection and construction and later the adequate maintenance of a system defensible upon economic lines.

In thus commending the new measure we do not wish to belittle the efforts of those who put through the first large-scale federal-aid appropriations. Imperfections were to be expected. There has been written into the new bill the lessons of experience.

The Need for Statistics About Business

NEVER before has so much attention been given in a public way to the use of statistical aids in the determining of business policy. Open-price associations have been attacked in a suit before the federal courts; they have been painted in the deepest black in the Lockwood building investigation in New York, and have been an important feature of a report to the President by the Federal Trade Commission. Private statistical service bureaus are multiplying rapidly and are strongly presenting in person and in advertising the advantages accruing from statistical guidance of commercial and industrial enterprises. Their growth is evidence of a new appreciation by business men of the value of such statistical service. Finally, Mr. Hoover in his address before the U. S. Chamber of Commerce at Atlantic City proposed the establishment by the government of a statistical service covering every great commodity and the more important industries. The subject is pertinent to the work of engineers and contractors, for the building material industries are involved.

Those who see evil in the collection and exchange of statistics are interested primarily in preventing them from being used to the detriment of the public—a position thoroughly sound. The public interest is paramount. However, in the sweeping condemnations that have been made, as exemplified in the one-sided Lockwood investigation, there is no admission whatever that figures may result in good to the public, much less of the fact that they are necessary for the stable conduct of business, and thus have a positive bearing on the welfare of every citizen.

Of course, eternal vigilance is still the price that the public must pay for protection against a goodly portion of the business community. In other words, most business men are human and when the opportunity is offered, will take advantage of the public. But that does not detract from the fact that some measure of co-operative effort is not only required, but is in the interest of the public. The problem is to devise methods for securing the advantages which should accrue to the public and industry from group effort while erecting safeguards to prevent the exploitation of the public.

Two excellent examples of how the public may benefit from the gathering of industrial and commercial statistics will be found in Mr. Hoover's address in the business news section of this issue. It is pertinent to note, however, that the benefits come not from the mere gathering of these statistics for the industries but *from their dissemination to the public*. Therein is the crux of the situation. There is strong temptation when information is held within the industry to allow it to be used as the starting point of collusive operations. The danger of this temptation would be lessened if the figures were given to the public, for the buyer would thoroughly understand conditions and be in a position to detect collusive effort.

The policy of publicity of figures has been followed to an extent in some industries. The results have been satisfactory, as witness the generally favorable attitude in business circles toward the U. S. Steel Corporation. Even in the steel industry, however, the facts made public—relating chiefly to furnaces in blast, the volume of production and the volume of business being placed—do not go nearly as far as a government statistical department would go. There would be rather full data on production, consumption and stocks, with information regarding capacity of the industry and the percentage of plants in operation. Manufacturers' prices, as a check on profiteering dealers, should also be published, at least for the basic industries.

The object, within industry, to be accomplished by full statistical information is to secure a more intelligent guidance of industry and trade. Every business man makes constant efforts to ascertain what his competitors are doing, and though it may take time he eventually does learn what they are doing and guides himself accordingly. But while getting the data his business may suffer grievously. There may be serious over-production with consequent heavy bank carryings, sharp lay-off of employees, and all the other evils which go with organization disruption, and idle industrial plants. Full information of what is going on in the industry allows tendencies to be sensed at the very start, and the application of remedies that will assure the flattening of the peak. This tends to a healthier industrial condition—which is of universal advantage.

The dissemination, whether through open-price associations or a government agency, of price information, as distinguished from production information, also tends to eliminate the "competition of ignorance." Underselling of fair prices by those with no knowledge of their costs is a common industrial evil. Such practice eventually eliminates the unfortunate individual, but not *until the public has paid the bill* through liquidation.

Without doubt there will be objection to government publication of statistics by those fearful of more government interference in business. The benefits to be derived are too great, however, to allow their fears to prevail. It is commonly conceded that our business men generally guess at the future and decide their courses from day to day, instead of laying down policies based on a thorough understanding of conditions. Anything that will get us away from this policy of "playing hunches" will be of general benefit.

Such sentiment is building up against open-price associations that they are quite likely to be prohibited by law, even if under the present court proceedings they are found not to violate the anti-trust laws. If that should result, some other means to the same end must be found. The government collection and dissemination of data offers a solution.

Concrete Dam on Eel River Built on Shale Foundation

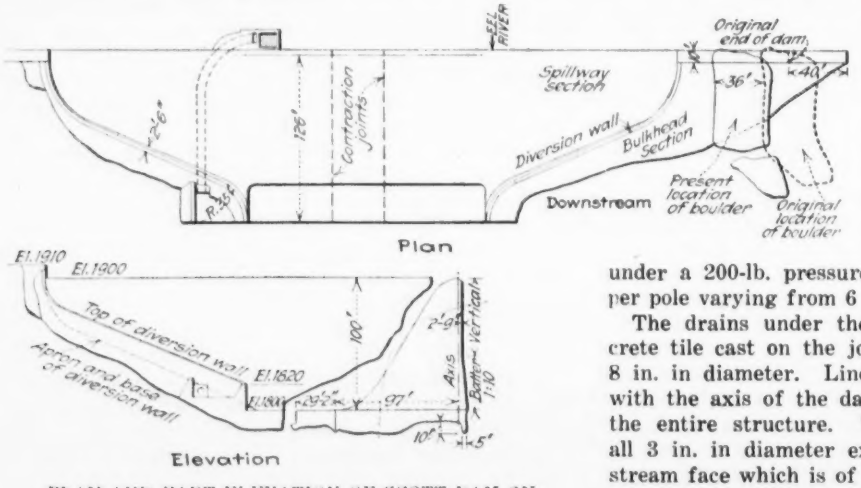
Dam Lengthened After Rock Slipped at Abutments — Extensive System of Sub-Drains Used— Elaborate Chuting Plan From Auxiliary Trestle

There is now under construction on the Eel River, about 150 miles north of San Francisco, a gravity section concrete dam, known as the Scott dam, which is noteworthy both as to design for the provisions against underflow and in construction for the comprehensive chuting plant which has been installed. The structure is furthermore of interest because of a large rock slip which occurred at one abutment and which has necessitated the extension of the dam about 40 ft. beyond its original length. In the first of the following two articles the sub-drainage design and the difficulties due to the slip are discussed. The second article is devoted to the concrete placing operations.

The dam is being built for the Snow Mountain Water & Power Co. The designs were prepared by B. C. Conduit and the work has been carried out under the direction of Edwin H. Warner, engineer in charge of construction. W. A. Kraner, of San Francisco, holds the contract for the work.

Drainage Design and Foundation Difficulties of Dam

THE Eel River dam is a gravity concrete structure originally designed to be 725 ft. long but later extended to a length of 765 ft. and 135 ft. high. Of the dam crest length 485 ft. is treated as spillway and in order to prevent the overflow from cutting around the ends of the structure curved deflector walls were designed on the downstream face of the spillway from crest to toe, these walls converging so that where they terminate at the toe the width of the spillway will be decreased to 185 ft. From the downstream toe an apron extends 30 ft. along the river bed below the dam proper and is extended down to the shale rock below.



PLAN AND PART ELEVATION OF SCOTT DAM ON EEL RIVER, CAL.

Boulder which moved is shown on the right of the plan.

When an examination of foundation conditions was made at the site of the dam, exploration tunnels and shafts disclosed a shale formation with talcose intrusions. The shale was pronounced firm enough to carry the weight of the dam provided water was kept out of the foundation. Accordingly, the axis of the dam was shifted until the structure could rest entirely on shale, and provision was made for grouting below the cut-off wall to make the seal at the upstream face as effective as possible. Furthermore, a network of underdrains was specified to carry off seepage water which might find its way under the structure.

Last season parts of the dam were completed to the full height of 135 ft. The excavation made before the first concrete was poured extended 15 to 25 ft. below the ground surface for the full width of the dam and a cut-off trench on the upstream face, 5 ft. wide, was carried 10 ft. deeper than the adjacent excavation. Before pouring concrete, 3-in. pipes were left in the cut-off wall forms, spaced 5 ft. apart and placed so that their tops would protrude on the upstream face of the concrete just above ground level. Through these pipes 1¾-in. drills were driven to a depth 30 ft. below the bottom of the cut-off wall and when the concrete had hardened, these holes were grouted under a 200-lb. pressure, the amount of cement used per pole varying from 6 to 150 sacks.

The drains under the dam consist of porous concrete tile cast on the job in 18-in. sections, 3, 6, and 8 in. in diameter. Lines of drains were laid parallel with the axis of the dam and on 15-ft. centers under the entire structure. These longitudinal drains are all 3 in. in diameter except the line nearest the upstream face which is of 6-in. tile. By means of risers, each of these lines is connected every 80 ft. to cross lines of 8-in. tile, imbedded in the concrete 5 ft. above the bottom of the excavation. The 8-in. lines in turn are connected by risers to a gutter at one side of a 3 x 5-ft. inspection gallery which is to run entirely through the dam beginning at levels near the top at both ends of the structure and extending thence down to a central level 85 ft. below the crest of the dam. From its lowest point this gutter discharges through a 12-in. pipe leading to the downstream toe.

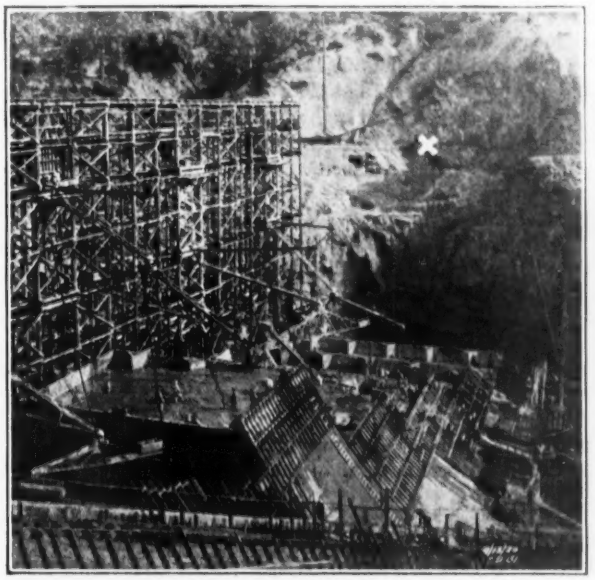
Waterways through the dam left in the concrete include a 3 x 5-ft. sluiceway, controlled by a sliding gate on the upstream face, and a 6-ft. circular outlet-pipe imbedded in the concrete which may later be used for operating a 2,000-hp. waterwheel. It is planned to build a small power house for this waterwheel just below the dam. The pipe is controlled by a butterfly valve and a needle valve at the downstream end, with provision for emergency closure by means of a sliding gate on the upstream face of the dam.

Two sluice-ways through the dam, used as a bypass for stream flow during construction, are to be filled up after completion of the work by concrete delivered through six pipes, three in each sluiceway, left in the dam for this purpose. In effecting closure, which is to be done at low water, stop-logs will first be placed in a double set of grooves at the upstream end of each sluiceway and the space between them will be filled with concrete, thus effecting a permanent seal. A wooden bulkhead will then be built in each sluiceway downstream from the concrete pipe nearest the upper end, and the section thus closed off will be filled with concrete, pouring from the top of the dam through the pipe imbedded in the structure. When this section is full and the concrete has set, the bulkhead will be moved below the second pipe and the process repeated.

As an additional precaution in anchoring the plugs in the sluiceways, a notch in the shape of an inverted V was left in the sluiceway roofs at the lower ends of the concreting pipes, this space to be filled by concrete as the closure is effected. The sluiceways were also tapered to a decreased cross-section at lower end.

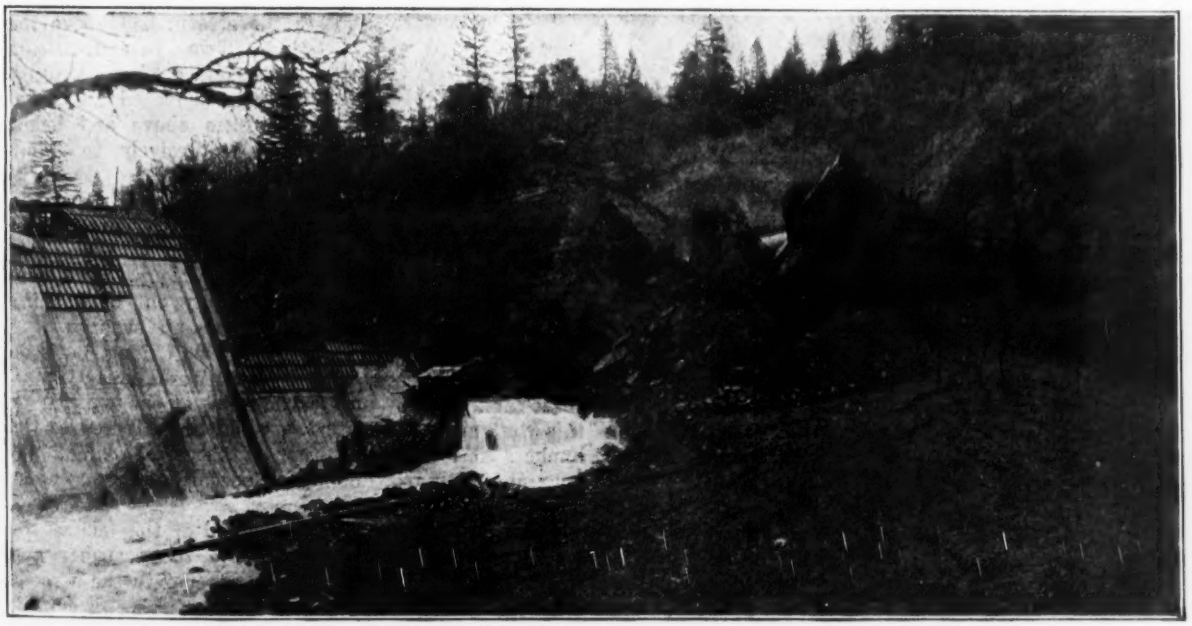
After completion of the concrete work on the dam, which is to include a ¾-in. coating of "gunite" on the upstream face, it is planned to place a puddled clay fill on the upstream side, reaching about 12 ft. up on the concrete and extending across the canyon from end to end of the dam.

The dam was well along toward completion when work was shut down for the winter in November, 1920, on account of early rains. After a period of heavy rainfall and high water the ground at the south abutment, against which no concrete had been poured, settled and moved downward toward the uncompleted structure. A hydraulic giant was used to remove the soft material in this slide and decision was then made to increase the length of the dam crest about 40 ft. and, with this exception, to complete the structure on the original plan as early in the present spring as water permits.



POSITION OF BOULDER AT ABUTMENT OF DAM IS INDICATED BY CROSS AT RIGHT

The movement on the south bank did not occur without warning. There were frequent, though slight movements of the surface on this bank of the stream even through the dry season. This was shown by the changes in level of bench marks established there during construction. The November movement that occurred after the high water, however, moved a mass of metamorphic rock which was previously supposed to be in permanent position and against which it had been planned to pour concrete. This movement is attributed by power company engineers to the fact that the flood which swept through the gap between the uncompleted portion of the dam and the south abutment loosened and softened the layer of material between the rock and the shale beneath. At the same

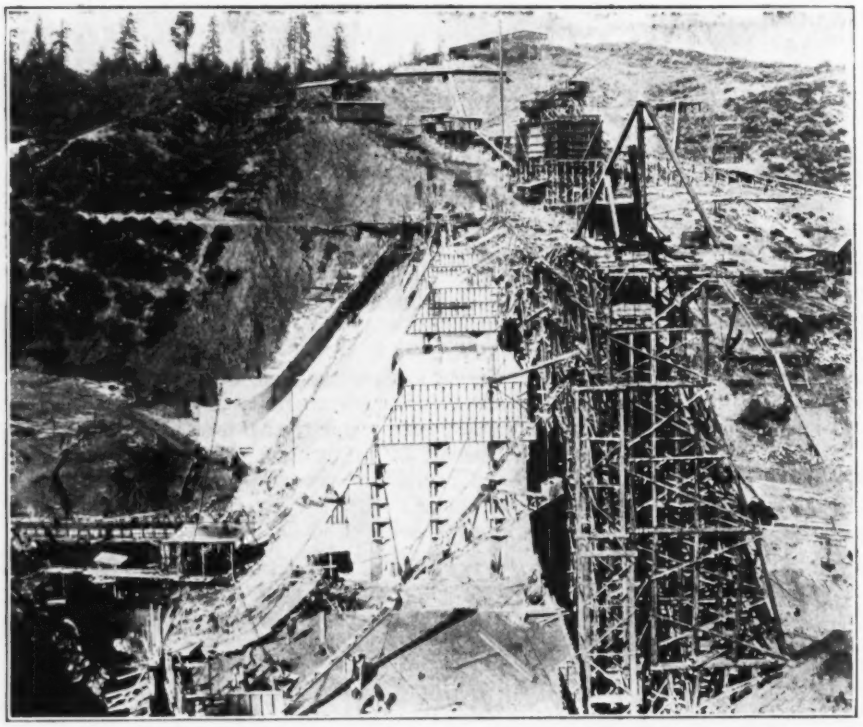


SOUTH ABUTMENT AFTER THE BOULDER HAD MOVED DOWN TOWARD THE DAM

time there was a general movement in the overburden of loose material, and the surface of the south bank was effected for some 500 or 600 ft. up and downstream and about the same distance up the slope of the hill.

After the movement a hydraulic giant was used to remove the material behind this face of rock previously considered as an abutment. When this exposure had been made the rock was pronounced a true boulder because of its conchoidal shape and the striations upon it. It is estimated to contain between 6,000 and 7,000 cu.yd. and is classed as belonging to a later geological age than the underlying shale. This boulder, according to the belief now held, originally came from some point upstream or farther up the hill and is entirely foreign to the shale formation underlying the dam. The November movement in the south abutment carried the boulder 36 ft. toward the dam, and left it at a level 20 ft. below its previous position.

Although the material in the boulder was considered firm enough to warrant its incorporation in the concrete, decision has been made to eliminate it from the structure entirely for two reasons. If the boulder were left in place, tunnels would have to be driven under it in which to replace with concrete the strata of soft shale that overlies the hard shale. Also, after the completion of the concrete dam around the boulder, a portion of it would project on the downstream face, thus affording a lever in the concrete, as it were, which might at some time be a menace to the stability of the structure.



VIEW OF CONSTRUCTION PLANT FROM SOUTH BANK OF THE RIVER

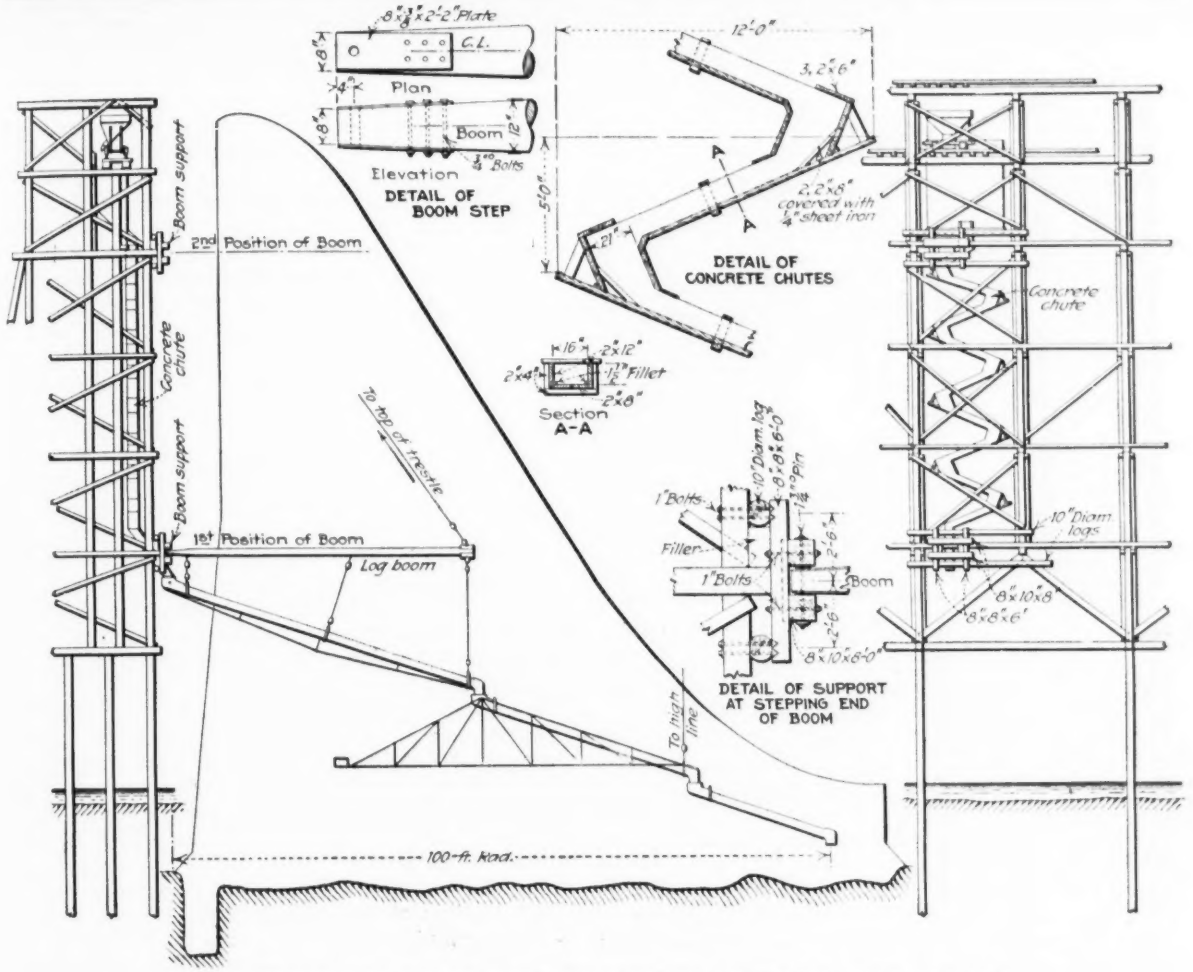
At the same time that the rear part of the boulder was exposed with the hydraulic giant, excavation was made of all material which could be moved with a 2-in. nozzle under a 350-ft. head in the area to be covered by concrete. About 30,000 cu.yd. of material was moved in this way, chiefly soft shale and talcose nodules. The material exposed by this work is reported to be a hard shale, entirely suitable as a support for the concrete of the dam. The plans for the dam were accordingly changed so as to increase its length by about 40 ft., as shown in the accompanying drawing. To complete the structure on the foundation thus exposed, after the boulder has been removed, is estimated to require about 4,000 cu.yd. of concrete more than was contemplated in the original design.

Efficient Plant for Handling Concrete on Dam

THE construction plant for the Eel River Dam was selected and arranged to use local advantages to the utmost and to maintain the maximum speed in placing concrete. Before the construction crews went to the job complete detailed drawings were made for all structures involved in the construction plant and the plans for these were carried out consistently without change. The contractor deemed it economical to build a trestle exceeding the full height of the dam and to use in connection with this suspended chutes for delivering concrete. An exceptionally high degree of flexibility for the spouting system and a reduction to the minimum of mixer shutdowns on account of trouble in the delivery system are advantages claimed for this arrangement. Other features of the contractor's plant were screw conveyors for delivering cement and zig-zag concrete chutes to avoid a straight drop in the delivery of concrete.

Rock and sand for the concrete were obtained from pits in the stream bed above the dam. Two ¾-cu.yd. steam shovels and a 1¼-cu.yd. dragline skip delivered the materials from above and below water respectively to dump cars shunted into the pit. These cars were taken in three-car trains by locomotives, of which three were ordinarily kept at work in the pit, to the base of an incline leading up to the bunkers. The cars were rated at 4 to 4½ cu.yd. capacity but by heaping them up they were made to handle an average of 5 cu.yd. per load. The incline was 600 ft. long, built on a 24-per cent grade, and the cars were hauled up in three-car trains by an electric hoist at the top. With this equipment the materials could be delivered to the bunkers at a maximum rate of about 200 cu.yd. per hour and averaged, during periods of continuous operation, about 150 cu.yd. per hour.

From the hopper beneath the top of the incline the coarser material passed through a rock crusher and thence all of it went by bucket conveyor to the screens over the storage bins. Two screens were provided, each 40 in. in diameter and 20 ft. long. The rock



ARRANGEMENT OF THE TRESTLE AND SPOUTING SYSTEM ON EEL RIVER DAM

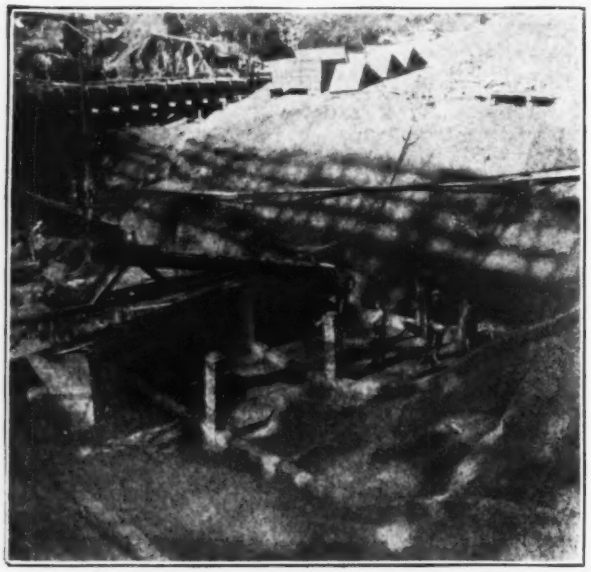
screen was divided into two 10-ft. sections, one having 1¾-in. holes and the other 3¾-in. holes. The sand screen delivered into the sand bin all material that would pass through a ⅜-in. opening. The three bins each had a capacity of 350 cu.yd. This arrangement being in accord with the finding, made before the work started, that concrete of maximum density would result when these materials were mixed in the proportion of 1:3:6, the 6 being divided into equal portions of fine and coarse rock as segregated by the screens. From these storage bins the materials went into the mixer hopper via a combination chute and measuring box.

In order to be at a point convenient for delivery of cement by motor trucks the shed in which the cement sacks were emptied had to be about 50 ft. away from the bunker structure. The plan first tried was to deliver loose cement from shed to measuring box by means of a 10-in. pipe set on a 45-deg. slope. When it was found that the cement would not flow satisfactorily on this grade a screw conveyor 50 ft. long was substituted which discharged into the cement measuring box. A second screw conveyor delivered the cement batches from measuring box to mixer.

The mixing equipment consisted of two 2-cu.yd. batch mixers, this capacity being selected with the idea that when the entire distribution system was in running order they would supply concrete as fast as it could be handled. During the height of the work it was found that as much as 175 cu.yd. of concrete could be placed per hour and that it was possible to average 1,500 cu.yd. per 12-hour day continuously. During the month of October a total of 31,500 cu.yd. of concrete was poured. As originally designed the dam was to have contained 86,400 cu.yd. of concrete. Of this total 79,200 cu.yd. were poured before the work was closed down for the winter.

At the outset of the work observation tests were made on concrete turned in the mixer for periods varying from 22 to 60 seconds, the time being measured from the instant at which the charge started into the mixer to the instant at which it started out. The result of these observations was the decision that a complete admixture of the materials was attained in three-quarters of a minute. As the mixers were operated at 13 r.p.m. a three-quarter-minute mixing period meant 9 turns per batch, and this was adopted as standard throughout the job.

Each mixer discharged into a bin with two outlet gates, the outlets being separated by a central partition of such height that a batch would fill the bin to a level just above the partition. Thus, after both mixers had discharged into their bins, it was possible to load four cars simultaneously. The outer walls of the bins were carried up high enough so that two batches of



DRAINS UNDER DAM BEFORE POURING CONCRETE

concrete could be put into each when desired, thus affording a storage capacity that sometimes avoided the necessity for shutting down the mixers on account of a brief delay somewhere in the delivery system.

Before any concrete was poured a driven-pile trestle was built close to the line which marked the upstream face of the dam. Piles, bracing and caps for this structure were all cut in the woods near by. The trestle was built to a height slightly above the top of the dam, but in order to keep to a minimum the length of the incline from the gravel pit the entire bunker arrangement was worked out so the mixers would deliver by gravity to cars that could run on an approximately level track to a stage of the trestle 12 ft. below its top.

When all the concrete which could be delivered by gravity from this level had been poured the tracks were moved to the top of the trestle. The remaining 10,000 cu.yd. of concrete was discharged from the mixers directly into the cars, the 12 ft. of elevation that made this possible being gained by eliminating the bins between mixers and cars. The cars were of 2-cu.yd. capacity with wedge-shaped bottoms and 12 x 24-in. gates on one side. A single track was provided on the trestle with sidings to enable incoming and outgoing trains to pass.

It was found that the operation of discharging concrete from the cars was delayed by the necessity for using a shovel to loosen concrete which caught in the corners. When this was discovered fillets were welded into the corners of the cars, thereby obviating the delay and saving for each of the two trains one-twentieth of the time consumed in its round trip, thus increasing by 10 per cent the rate at which yardage was placed in the dam.

A feature of the construction program was the use of four 50-ft. booms set about 80 ft. apart on the side of the trestle facing the dam. A hopper of capacity sufficient to hold two train loads of concrete was located alongside the track on the trestle and immediately above each boom. A zig-zag wooden chute connected this hopper with the inner end of the chute suspended from the boom. By means of the counterbalanced arrangement shown in the drawing on p. 753, each chute and boom could be swung so as to deliver concrete anywhere in its half circle of 100 ft. radius. The advantage of using four booms was that while the spouting system on any one of the booms was being changed or adjusted there was no stoppage of the steady flow of concrete, the cars being routed, in the meantime, to the next boom.

Beginning with the full spouting arrangement shown, as the level of the concrete rose, 10-ft. sections of the chute were removed from the outer end one at a time until only the section under the boom remained. The boom was then raised 48 ft. to a level just below the track, and the full length of suspended counterbalanced chutes were replaced.

The concreting crew included 18 men assigned to the following duties: Two men at each mixer, operating gates that admitted material to the charging hopper; one man charging and discharging each mixer (including operation of the water barrel); one gateman at the mixer hopper loading dump cars; two engineers on 3-ton gasoline locomotives that handled cars from mixer to trestle; two men opening gates on concrete cars; one man above the cars at dumping point to insure thorough dumping; one hopper man at head of the zig-zag drop chute; one rigger to swing and adjust booms and spouting system; one foreman and six shovel men in the concrete.

The forms consisted of 5 x 10-ft. wood panels, which were moved upward as the work progressed. These forms were held in place by tie-wires attached to runs of No. 6 anchor wires spaced 4 ft. apart vertically. With these stays on the inside and guy wires on the outside of the forms each panel was held in place without wood bracing.

Pouring was ordinarily continued in alternate, full-width sections of the dam 40 ft. long, a lift of about 5 ft. being made at a pouring. The forms were kept 10 to 15 ft. ahead of the concrete level and were stripped three days after pouring.

Plans for Greater San Francisco

A program of civic and industrial development in San Francisco was outlined by Dr. B. M. Rastall at the annual banquet of the Chamber of Commerce of that city. Dr. Rastall has been engaged for several months in making an industrial survey of the city and the address reviewed the important features of the comprehensive report he is making to the Chamber of Commerce. The first of these recommendations were: (1) Removal of Rincon Hill to permit location of industrial district south of Market Street with easy access to waterfront and access to railroads entering city. (2) Reclaiming and replanning of Islais Creek flats to provide additional industrial sites and elimination of present barrier to through routes from city to natural industrial districts to the south. (3) Construction of great industrial terminals at Hunters Point, which would have deep water dockage and direct connection with railroads. (4) Additional harbor facilities and progressive harbor management to take advantage of proposals 1, 2 and 3. (5) Extension of street car systems under single ownership with adequate financial provisions. (6) Replanning of isolated districts now laid out on checkerboard plan with 25-ft. lots to permit of modern home district development. (7) Development of future water supply, making available large excess amounts to attract certain classes of industry.

Interstate Water Conflicts and Possible Solution

A Discussion by Representative Engineers

SUGGESTIONS by R. I. Meeker, irrigation engineer, Denver, Col., in *Engineering News-Record* Jan. 27, p. 157, for interstate co-operation to avoid conflicts over water rights and also to further the more complete utilization of our water resources have brought words of approval from many engineers, particularly in the West. Some communications on this subject have already appeared under Letters to the Editor. Eight others are given here. The general ideas advanced by Mr. Meeker seem to meet with approval by all who have expressed themselves on the subject.—EDITOR.

By C. E. Grunsky

Consulting Engineer, San Francisco, Cal.

SOME METHOD must be found of apportioning the flow of interstate streams to those in the several states who can make beneficial use thereof. The adjustment of rights among numerous claimants in any one state cannot be satisfactorily made without regard to the beneficial use, present and prospective, of the water of the interstate stream in the other states which have contributing watershed areas or into which the water has been taken or can conveniently be taken by canal. Co-operation of the several interested states is desirable. But there should also be help, in some cases at least, by the Federal government.

It appears almost axiomatic that the state should forever remain in control of storage sites and of the regulation of stream flow by storage. On interstate streams and on projects of great magnitude the Federal government may well take the place of the state or act in co-operation with the state in this matter.

No other natural resource exists which can be developed to greater advantage than the water of the stream. Nature replenishes the supply at its source. There should, therefore, be a sufficient inducement held out to secure its early full utilization. The development of water powers will assist materially in conserving the supply of fuel. But whenever the development of the water resources by private enterprise is permitted care must be taken that the government does not lose control. No grants should be made without limit as to time. Moreover, the control of the reservoir which serves to regulate the stream flow should never be allowed to pass completely into the hands of private interests. The storage reservoir is an aid to economic water-power development. It is needed to augment the supply of irrigation water in certain months of the year when the stream is at low stages and the irrigation demand is large. It is also of service in providing a dependable supply of water for municipal use, and in many cases it can be used effectively in cutting down the peak of the stream's flood discharge. The irrigator's requirements for water do not always coincide with the demand for power, and both the power operator and the irrigator desire to have their reservoirs full at a time when the owner of land, subject to inundation by floods, desires to have the reservoir empty in order that when the flood comes a part of it may find lodgment in and be retarded by the reservoir.

The manipulation of storage facilities by the state would almost automatically put the state into police control of the stream, because delivery would have to be made of the water from storage to those who have established rights and this delivery would be subject to supervision. This control would be of great advantage in some of the states, as in California, where no provision has yet been made by law for water masters to regulate the taking of water from the stream by those who claim or who have definitely established rights to take water therefrom.

Whenever it can be shown that a water power project or an irrigation project, of which water storage is a feature, is economically desirable the state, or the state in co-operation with the United States, should provide the storage facilities and should then deliver the water from storage at such charges as will give the government a proper return. There is nothing novel about this method of procedure. It is on a par with what has been done successfully in several states. Massachusetts, through a water board, has expended more than $40,000,000 for the construction of storage reservoirs and conduits for the wholesaling of water to Boston and twenty-seven or twenty-eight neighboring towns.

On the interstate rivers, such as the Colorado, where the control of the water by storage should, to a large extent, be far down stream, the construction of reservoirs under co-operation of the seven states of which parts are in the watershed of Colorado River cannot be hoped for. The storage work on the Colorado River should be done by the United States and the impounded water should be delivered to those who are ready to generate power with it and to the irrigation canals at fair prices.

Mexico will be a beneficiary from any large properly planned storage project on the main Colorado. The international aspect of the matter, therefore, deserves consideration. If the United States can deliver some of the stored water of the Colorado River without detriment to the developments already under way in this country to Mexico this should be done under treaty arrangement, such that the service will be clearly defined and the compensation to be made by Mexico will be fair and proper. The service which Mexico gets at present from the Imperial canal system is not protected by any treaty arrangement. In this respect Mr. Meeker's suggestion that a treaty prevails is subject to modification. The only treaty which contains any provision relating to the Colorado River is the treaty fixing the boundary between the countries and this merely provides that the interests of the United States in the navigability of the river shall be safeguarded. The canal which conveys water from the Colorado River into the Imperial Valley passes through Mexico and is managed upon Mexican territory by a Mexican corporation which is a subsidiary of the Imperial Irrigation District. The concession which Mexico granted in 1904 to this corporation contains a provision under which the Mexican land owners may use the water of the canal to one-half of its amount. It is under this concession that water diverted from the river on United States territory becomes available for the lands in Lower California. As Mr. Meeker would have it, there should be an agreement reached between the United States and Mexico relating to the irrigation development in Mexico which can be sanctioned by the United States, just as there should be co-operation between states on interstate streams, where a delimitation by artificial state boundaries of territory within which rights are granted and protected results in absurd situations.

By F. E. Weymouth

Chief Engineer, U. S. Reclamation Service, Denver, Col.

THE article by Mr. Meeker leaves one with a pleasant sense of agreement and expresses a trend of thought now developing. At least among engineers we are turning from legal strife as the solution of the question of rights in interstate streams to a more constructive view.

The article shows a viewpoint a long step in advance of the attitude held in the very recent past and still held by some. It shows recognition of the rights of users in the lower states. Interstate conflicts have arisen from just one cause—water which had been used in a lower state was diverted and used in a state higher on the stream. Generally these later diversions have prevailed over priority rights in another state. I do not know that any great actual destruction of property values has been caused by such diversion but it cannot be denied that there is a moral obligation to respect the lower rights.

Divided interests on a stream certainly do not make for the best development of the stream. The officials of the upper state have no jurisdiction to administer the stream within their state for the benefit of a lower state and to the detriment of the lands of their state. Once the development of the upper state has taken place it is idle to talk of an adjudication which may destroy the communities of the upper state in order to re-establish conditions which may have existed years before.

In general the present stage of development on most of our streams is such that the dispute is over the natural flow of the stream. There is generally at the flood period surplus water which can be stored and regulated to supply all rights. Instead of adjudications and legal battles, Mr. Meeker advocates replacement storage as a constructive way of dealing with the situation.

This is the course followed in the highly developed regions of eastern Colorado, all within the state and subject to one control. The Reclamation Service in its developments on a stream of necessity does not recognize state lines and must consider all existing rights. Some of its reservoirs are replacement reservoirs. It is comparatively easy to provide for existing rights by building a reservoir because these rights are already determined, but what of the potential rights which each state has in every stream flowing through it?

Irrigation development is not static; each year new acreage comes under ditch, a growth unnoted and unheralded. Periodically a crop of new and ambitious projects springs up. These possibilities are the potentialities which each state wishes to see developed within its borders whether or not it may jeopardize some older development where some teeming community is thriving. Another feature adds now to the importance of careful consideration of the proper regulation and development of the rivers of the West. Heretofore irrigation has been paramount, and it still is in general, but there are portions of the West where water power is now considered more vital.

Recognition of the necessity of considering potential rights as well as existing rights is the reason for the existence of the League of the Southwest and the Colorado River Commission, which organization consists of representatives from the Reclamation Service and from the seven Western states lying partly or wholly in the basin of the Colorado River. Here the interests of the Republic of Mexico must also be considered. Not so many years ago such an organization could not have functioned, perhaps partially due to mutual misunderstanding but mostly because there would have been nothing definite on which to work. But now the irrigation and power possibilities in the basin have been fairly well outlined and, fully as important, data have been gathered from many sources which enable the prediction with some degree of accuracy of how much water will be consumed in growing crops and how much of that which may be diverted will return to the stream.

All the engineers of this committee are agreed that the best solution of the Colorado River problem is the construction of a large reservoir at Boulder Canyon, or vicinity. It will provide in advance the replacement storage advocated by Mr. Meeker and will in effect separate the Colorado into two rivers, the Upper and the Lower. At present, while widely separated by distance and with entirely different economic conditions, the two parts of the basin are mutually interdependent as to water supply and development in one part may jeopardize the water supply for another.

The result of the work of this league may be virtually an apportionment of the waters of the Colorado to the different states. If it works out satisfactorily, as we now expect, the same basis may be used in solving problems connected with other large interstate streams. While the Colorado is a large problem, yet its relative abundance of water supply does not create, from an engineering viewpoint, so delicate a situation as exists on other streams where land and water are more nearly balanced.

The Reclamation Service has in the last few years investigated projects which involved a detailed study of the entire stream similar to that now being made on the Colorado River. In essence this is what Mr. Meeker advocates and what is being done now co-operatively on the Colorado River. Notable examples are the Rio Grande and the North Platte, the latter in co-operation with the State of Wyoming. A striking feature of both these streams is the large area of seeped land lying in the flood plane of the river. Lateral seepage from the river, aided by irrigation diversion, brought about this condition, which could be remedied easily by drainage. These seeped areas are now in some cases evaporating more water than would be used if they were drained and irrigated. In consequence drainage will release water which may be used at some point downstream. I believe, therefore, that in addition to reservoirs drainage is needed before each state can realize in full its potential rights in the Rio Grande and North Platte and many other streams. While drainage of old lands can be brought about only by awakened public sentiment, yet precautions can be taken to see that new projects provide adequate drainage.

It is certain that far more can be accomplished by a dollar if it is used to drain and rejuvenate old partially abandoned lands, which naturally were the first and easiest irrigated, than if it be used to build ditches to cover new lands. Then, too, it seems not improbable that the water released by drainage may sometimes react favorably to the water supply for canals above. The effect may be the same as replacement storage. It behooves each state to study and aid in the development of its neighboring lower state if it has in mind its own largest potentialities.

By John E. Field
Consulting Engineer, Denver, Col.

IT IS to be hoped that Mr. Meeker's article will bring about a definite attempt on the part of the several states to get together.

Time in interstate water suits, as in many other things, tends to solve questions apparently much involved. It is the opinion of the writer that interstate difficulties are largely imaginary, theoretical or academic, and in time will largely disappear. For instance, the constantly increasing return seepage to the South Platte River is even now furnishing to Nebraska ditches a greater volume than was available during low water before irrigation was commenced in Colorado, and practically all the ditches need. The virtual abandonment of the use of water from the Laramie River on lands on the Laramie plains has left water for lands near Wheatland, Wyo., and for the Greeley-Poudre tunnel, even before the Colorado-Wyoming suit has been decided. The lack of financial success of the canals and lands in western Kansas tends to eliminate the insistence of Kansas on their claimed rights. The rapid development of drainage systems in the San Luis Valley will return much water to the Rio Grande, and by the checking of evaporation from the wet areas will compensate for any additional waters diverted by uses in Colorado. The growing knowledge of the amount of water available for use on the lower reaches of the North Platte and the return seepage indicates that water may be used in Wyoming and Colorado without affecting materially the use in Wyoming and Nebraska, especially under the government projects. The economy of use, better administration and detailed information of the limited areas irrigable on the western slope of the Continental Divide in Colorado, and the almost unlimited supply in the Grand River, show that transmountain diversions can be made without injury to western-slope users.

While it is the firm belief of the writer that physical conditions are such that Colorado cannot be and will not be injured in her ultimate development, interstate suits and prohibitions, uncertainties and possible adverse decisions will delay natural and proper development, in some cases, even beyond the present generation. It is this unnecessary delay to which Colorado objects and against which she must defend herself. The appropriations and large expenditures by the state have been necessary to secure data, to conduct a campaign of education both at home and abroad and to defend herself when attacked.

The time is probably now here when, with the information on hand, two states may sit down and draw a treaty of peace. Colorado fears no development in adjoining states

but she does fear the promulgation of laws or rules academic in character and temporarily detrimental to her present interests.

Mr. Meeker speaks of interstate ditches and mentions the Mitchell canal. As a matter of fact the state engineer of Nebraska has crossed the Wyoming line and has regulated this canal just as though it were all in Nebraska. In the proposed "treaty of peace" such action would undoubtedly be sanctioned.

Other instances of state co-operation are as follows: On the Republican River the Colorado water commissioner and the ditch company co-operate to make the distribution of the water in the Interstate ditch between the users in Colorado and those in Nebraska in accordance with the finding of the court. On the Pathfinder (North Platte Project) the reservoir so nearly regulates the flow of the stream that there is water for everybody, and most if not all ditches have purchased reservoir water from the Reclamation Service. Here, too, anticipated difficulties have vanished by common horse sense, business-like handling of the problem by the parties interested.

The most important item of interstate problems is the economic phase. Modified, perhaps, somewhat by property rights, the highest and best use of the water is in the public interest, and, indeed, in the interest of the users also. Entering into the economics of the problem are (1) losses in a river bed; (2) availability of the return seepage for irrigation; (3) the duty of water, the amount which in addition to the rainfall is necessary for the irrigation of an acre of land, the unit of volume being measured at the source of supply; (4) the crop return per unit of volume of water used, with due regard to whether the product is an essential or merely a desirable "luxury" crop; and (5) whether the area to be irrigated in addition to raising crops is desirable as a place of residence for the land owner.

The higher up on the stream water is used the less is the loss in transit in the river bed, and the oftener are the return waters rediverted and reused. In the semi-arid region the streams lose in volume after leaving the foothills, especially during low flow, when the water is most valuable. The farther we get from the mountains the less the fall and broader and sandier the stream bed. The rainfall decreases from the foothills to a point where the effect of the approach to the humid region is felt. In Colorado the precipitation decreases for about 100 miles from the mountains easterly, and from there it increases gradually until the non-irrigation section is reached at about meridian 100. The water should therefore be used as near the foothills as is practicable.

While fruit and semi-tropical products have come to be a regular part of our daily diet, they still are not as essential as wheat, oats and the cereals generally. Furthermore, the cereal area of the United States is limited and little remains undeveloped, while the unused area suitable for semi-tropic crops is very great. Greater weight should be given, therefore, to the necessities of those regions capable of raising the cereals and such crops as are produced in the colder sections of our country.

The production of crops is desirable and necessary, but more desirable and more necessary to our national welfare is the production of homes, and especially of farm homes. There is no better place for homes than on our high plateau regions.

If state lines are to be eliminated (see *Engineering News-Record*, Feb. 10, p. 274) then let users in Colorado purchase the lands in western Kansas, cease such irrigation as interferes with the irrigation on the higher reaches of the river, and convert the Kansas land to such use as it is better fitted for. Conversely, if Kansas land owners can afford to pay for water rights in Colorado and transfer them to Kansas let them do so. In the end better land will be irrigated, more crops produced, more homes established and the lands less valuable for crop production would revert to some other use. Under such a rule of transfer Colorado feels that no water she needs would pass beyond the borders of the state.

In my opinion, no necessity exists for any general rule or law in regard to insterstate matters. In all the cases in which Colorado is or may be involved, and in all others with which I am familiar, the physical condition and historic facts are such that each case contains within itself the basis of a practical equitable solution. When the Western states sit around a peace table this condition will be apparent to all, and the peace terms can be drawn for each drainage area with justice to all and prejudice to none.

By D. C. Henny
Consulting Engineer, Portland, Ore.

THE existing conflicts between the interests and rights of adjoining states in the matter of economical use of water in interstate streams has been clearly set forth by R. I. Meeker in *Engineering News-Record*, Jan. 27, p. 157. He quotes several interesting instances, some of which are pending in the U. S. Supreme Court, while others must ultimately go there for final decision. The number of quotations can be readily multiplied. On the California-Nevada line state rights are involved in the control of Lake Tahoe, the outflow from which enters Nevada. An opposite question, so far as California is concerned, is likely to arise on the Klamath River, which flows from Oregon into California, and also on the lower Colorado River, where in addition an international question is involved. Another international problem is presented by the St. Mary and Milk Rivers, both flowing from Montana into Canada, the Milk River, however, returning to the United States. This particular subject is covered by a treaty with Canada to which, however, Montana, claiming rights in both rivers, could in the nature of the case not be a party (see *Engineering News-Record*, Dec. 30, 1920, p. 1277).

Mr. Meeker quotes claims made by the State of Washington on behalf of its Columbia Basin project. Storage is required on the Pend Oreille River in Idaho and on the Flathead River in Montana. The United States is directly interested in Flathead storage, which is in an Indian reservation, while an international question is involved, since heavy diversion (20,000 sec.-ft.) from the Pend Oreille River and storage in the upper basin may affect Canadian rights. Use of Columbia River flow for power by the construction of dams across the stream at such points as Priest Rapids and Celilo Falls may also be complicated by an international question, as an existing treaty with Canada provides for an open river from the Canadian line to the sea. Another international question of great importance may arise on the lower Rio Grande, where an area of nearly 200,000 acres has been highly developed by irrigation pumping, all situated on the American side. At times of extremely low stage practically the entire river flow is used. Excellent and easily reached irrigable lands lie on the Mexican side and since the greater part of the flow originates in Mexico claims may be set up by it in the future to part of the water.

The general problem, so far as it is a purely technical and economical one, can undoubtedly be treated satisfactorily by engineering commissions such as Mr. Meeker suggests and one of which relating to the Colorado River has been organized recently. So far as the problem is a legal one the obstacles in the way of early progress seem almost insuperable, partly due to the usual attitude of the legal mind, which worships precedent and is but rarely constructive.

The problem, at least as it presents itself in the West, would be brought somewhat nearer solution if a Federal Department of Public Works were created as provided in the McCormick senate bill. Such a department would have or could most effectively collect the necessary physical and technical data. It would have the advantage of a trained legal staff familiar with engineering problems and imbued with a spirit of overcoming obstacles and suggesting remedies. On the one hand such a department could invite the co-operation of the individual states and on the other it would be in close touch with the State Department for the treatment of international phases of the work.

Whatever means are employed to clarify the present serious, uneconomical and embarrassing muddle, engineers should recognize that at present the most formidable obstacle is not technical but legal and that in the formulation of any program constructive legal advice is indispensable.

By C. J. Ullrich

Deputy State Engineer, Salt Lake City, Utah

QUESTIONS of adjustment of interstate water conflicts, the determination of water rights and the regulation of the flow of interstate streams are becoming of moment to most Western states, not only with respect to the larger interstate streams but also with respect to the smaller ones on most of which the normal flow has been already over-appropriated.

On the smaller interstate streams the interests of only two states are as a rule involved and the interstate problems are not as numerous and conflicting as are those on the larger interstate streams; also the methods applicable to the solution of these problems are not always applicable to the larger interstate streams, and if so they may become cumbersome and unwieldly in application.

The problems involved in working out an economic plan of ultimate utilization of the water in interstate streams are generally peculiar to each stream and no hard and fast rule can be laid down for their solution. However, the basis for adjusting such problems must be co-operative authority. Unless such authority is delegated to some state official in each state there can be no starting point. Realizing this lack the state engineer of Utah has recommended to the legislature the enactment of a law providing for co-operation with Wyoming in the determination of the rights and the regulation of the flow of Utah-Wyoming interstate streams, contingent upon Wyoming passing a similar law. There are several streams, including the Bear River, flowing between these two states.

Under the present irrigation and water rights law of Utah no cognizance is taken of prior rights in an adjoining state on interstate streams nor has the state engineer power to grant applications that contemplate the appropriation of water in Utah from such streams to be used in Wyoming. This condition has resulted in blocking several smaller irrigation projects on these streams because no valid title to the use of the water could be secured from the state. The recommendation of the state engineer is meeting with favor among the legislators and it is hoped that it will be enacted into law.

The writer agrees with Mr. Meeker that the enforcement of interstate priorities is not always practical. The physical conditions of the watershed, location of reservoir sites, replacement storage, return flow and the equitable proportion of state benefits may all mitigate against the enforcement of such priorities. Should interstate priorities be enforced under adverse conditions it means that the ultimate utilization of the water of a river system is an impossibility. The Federal courts in adjudicating rights on interstate streams have in the past adhered rigidly to the enforcement of such priorities. While the theory of Western water rights law upholds this procedure, the writer doubts its efficacy.

Within the states priority of right should be fundamental, but as between states the doctrine of the greatest good to the greatest number should prevail. The foundation of state prosperity is agriculture and to deny the citizens of a state the use of water from an interstate stream merely because citizens of an adjoining state have a prior claim at the lower end of a stream is denying the state the right of developing its agricultural possibilities. The history of irrigation in the West has proved that the use of water on the upper reaches of a river system is of benefit to the users on the lower river as the return flow in the course of time builds up the low water flow to a point where it stabilizes the lower rights as against seasonable low water fluctuations.

Again, the enforcement of interstate priorities upsets intrastate priorities that may have been established through state courts or other state agency and renders uncertain and indefinite what has already been declared as certain and definite. In other words, it makes a title to the use of water granted by the state questionable and may result in upsetting industrial and agricultural development initiated by virtue of the state having granted or decreed the title to the use of water.

The writer does not wish to convey the impression that interstate priorities should not be enforced, for they should be, but only when their enforcement brings about the ultimate utilization of all the water of a river system.

The method now being followed on the Colorado River for the solution of interstate water conflicts, as outlined in Mr. Meeker's article, appeals to the writer as the proper one, for it is based on co-operative authority exercised through a commission.

By J. C. Stevens

Consulting Engineer, Portland, Ore.

THERE is no question in my mind but that the old lower river vested right must for suitable considerations give way to the growing demand for increased agricultual development. While assistant state engineer of Nebraska in 1902-03, I knew of cases where, in order to supply lower-river vested rights for one acre of land, water enough was lost in transit by evaporation and percolation to have copiously irrigated from five to ten available acres on the upper river. Many such instances can be cited for the Platte, Republican and Arkansas River basins.

Where such conditions exist on interstate streams the control must be vested in an authority not bounded by state lines. Where conditions permit one obvious solution is to pool all water rights, construct impounding reservoirs and have the water distributed by some such unrestricted authority. Where adjoining states have similar irrigation district laws there appears to be no reason why an entire drainage area could not be organized into a single irrigation district regardless of state lines. Many irrigation problems that a few years ago appeared impossible of solution are today being successfully handled by properly officered irrigation districts. Such districts, working in co-operation with federal agencies, will be able not only to make the vitally necessary engineering investigations but also successfully to finance the construction of irrigation works.

It is not likely that a general solution of these problems can ever be made. Instead each interstate stream will probably have to be handled on its own merits.

By J. B. Lippincott

Consulting Engineer, Los Angeles, Cal.

In arid America the question of the division and distribution of water is of intense interest, vital to the life of the communities concerned. Therefore, as R. I. Meeker (*Engineering News-Record*, Jan. 27, p. 157) proposes a plan for dealing with the largest rivers in the western half of the country, his subject becomes correspondingly important. As he states, with many of the largest streams, such as the Platte, Rio Grande and Colorado, there is special necessity for broad and impartial study of the maximum benefits to be obtained. The available water supply is largely the measure and the limit of the ultimate development of the region in which it is used.

Throughout arid America it is recognized, with reference to the ownership of water, lands and minerals, that he who is first in time in his application is the first in right, and as far as the water is concerned that beneficial use is necessary for maintaining ownership. In the regions of Europe practicing irrigation this theory is basically the principle of the Latin law relative to water and is distinct from the riparian law, which is derived from England, a humid country, where water is of value principally because of its bank rights. Right based on priority has been accepted generally throughout their arid regions, in some states being modified by a peculiar blending with the riparian laws. It is recognized as the international basis of settlement of conflicting claims on the Rio Grande where the United States has contracted to deliver fixed amounts annually to the intake of old Mexican canals opposite El Paso. This general theory of recognizing priorities has been recommended for the division of the Nile between Egypt and the Sudan.

Water is "property," and it would be exceedingly difficult if not unconstitutional for any state or other authority

to attempt to take prior vested water rights away from lower areas on a stream for the benefits of districts situated on the headwaters of the rivers, as suggested by Mr. Meeker, irrespective of the relative benefits that might accrue from use in either place. It would be impossible to proceed with the development of great projects on the lower Colorado or Rio Grande that are now under way if there is to be a serious prospect of the water ultimately being withdrawn for use on other areas higher up in the drainage basins.

For years there has been a demand on the part of the Western States and territories to break away from Federal control of national resources. Where the central government has yielded to the state in these demands the results have generally been unsatisfactory. The handling of state school lands and the extravagant if not illegal distribution of the swamp and overflow lands given to the states illustrate this. The attempt on the part of the states to carry out the provision of the Federal Carey irrigation act involving grants of public lands to them is another example. The states are not only jealous of the authority of the United States within their boundaries but they are also exceedingly suspicious and aggressive against each other, as indicated by the strife between Colorado and both Kansas and Nebraska over the Platte and Arkansas.

Federal authority, as represented by the U. S. Reclamation Service, the U. S. Geological Survey and the U. S. Department of Agriculture, has demonstrated its integrity, ability and fairness in its discussions of land and water problems in arid America. The government is the largest owner of land and riparian rights on our interstate streams. As owner of public lands, which when reclaimed must bear largely the cost of construction for their development works, the United States naturally would insist on the control of expenditures and the determination of public policies relative thereto. The accomplishments of the Federal government in reclaiming lands, particularly through the agency of the Reclamation Service, are in vivid contrast to the failures of the states in the handling of such problems. The solution by the government of the Rio Grande problem, involving three states and two nations, has been eminently satisfactory. The same is true of the Colorado River, where projects have been built for the benefit of Colorado, Utah, Arizona and California. Their plans are maturing along rational lines and there is no apparent reason for terminating their authority.

No particular injustice has been observed in interstate irrigation projects that have been operated by the Reclamation Service. States dealing between themselves would have had greater difficulty. Manifestly the states could not properly deal with international adjustments of water problems such as occur with Milk River on the Canadian border, and the Colorado and Rio Grande in Mexico.

Mr. Meeker writes of the saving that would follow the use of water near the headwaters of streams as compared to utilization on the lower reaches where extensive losses by seepage and evaporations occur. It is also true, however, that crop values per acre are often greater in lower, warmer elevations than in higher mountain meadow lands. The adjustment of these problems of vested rights and economic values by the regulation of floods is highly desirable. It is difficult to see how this can be accomplished other than by Federal authority. Surely states such as California and Arizona would have to wait a long time for Colorado and Utah to assist in the extension of their irrigated areas. California and Arizona could not well construct great storage reservoirs outside of their boundaries.

Mr. Meeker refers to the recommendations of the League of the Southwest, as indicated by the resolutions adopted at the last convention at Denver. The policy outlined by these resolutions is not constructive and it is inimical to the broadest developments of arid America. The U. S. Department of the Interior has withdrawn public lands in known reservoir sites; for instance, in the basin of the Colorado River, pending a broad and comprehensive study of the regulation of that stream and its utilization for the development of water power and irrigation. These investigations have proceeded diligently and continuously. The high mountain states resent the withdrawal of these reservoir sites from public entry for the possible benefit of lands on the lower portions of the stream. On the one hand the resolutions of the League of the Southwest insist on the immediate opening of these withdrawn areas for various forms of private use, and at the same time they propose a conference of state and national officials for the purpose of considering a general agreement to be ratified by state legislatures and act of Congress for the division of the waters. It is manifest that this would bring about acrimonious and involved negotiations extending through a term of years. In the meantime these natural opportunities would be largely lost, due to minor private filings. It is contended by the writer that such a policy would be much less to the general public interest than that which now obtains, to wit: the holding of these natural opportunities under Federal control, pending an investigation by a comprehensive and impartial authority.

It is believed by the writer that (1) the work which has been done by the Federal government for the reclamation of arid lands has been satisfactory; (2) that the administration of state land grants has been unsatisfactory, and (3) that it would be a mistake to throw this subject into a conference of partisans. The introduction of a congress of engineers and attorneys representing state rights and ambitions would lead to confusion, strife and delay. It is hoped that the U. S. Reclamation Service, which is an organization free from politics, scientific in its work and efficient in its construction, will be continued unhampered in carrying out the great work which it has demonstrated it has capacity to perform.

By John T. Whistler

Consulting Engineer, Chicago

PROBABLY no more glaring example of injustice arising from *intra*state administration of *inter*state streams can be found than exists on the Bear River, Utah-Idaho.

Bear River rises in Utah, flows into Wyoming, thence into Idaho and finally into Utah and Great Salt Lake. The waters of Bear River in Utah are over appropriated for the period of low discharge, while in Idaho there is practically no shortage. Rights from the river in Utah are all adjudicated and diversions are regulated by the state. Subsequent in time to other decreed rights certain lands in Utah acquired a right in Idaho to divert just above the state line, and since the diversion point is above those of other users in Utah these lands with an Idaho right have in effect a water right superior in fact though inferior in time to other Utah lands.

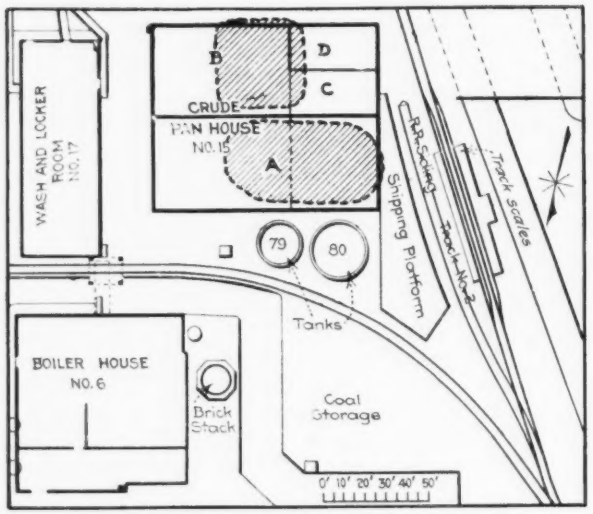
This statement may not be entirely correct in detail, but even if incorrect in all particulars it well illustrates the necessity for some other than the present method of administering interstate streams. What this method must be will be indicated by the outcome of the long pending Laramie River case in the Supreme Court referred to by Mr. Meeker. "Home rule" is certainly desirable in just so far as it can obtain without injustice. Results in other interstate matters would appear to justify the conclusion that a definite and satisfactory solution of the problem by co-operation of the states acting as individuals will at best be a matter of a great many years. On the other hand Federal regulation of interstate transportation matters, for example, has been quite satisfactory.

Our Federal Government was originally organized for the very purpose of administering matters of interstate interest and to avoid a conflict between states. Does not the logical solution of the problem therefore appear to be to await the result of the pending Laramie River case in the Supreme Court, which is expected to determine the constitutional status of rights from interstate streams, then provide for administration by the Federal Government either by appropriate legislation by Congress or by constitutional amendment as the finding of the Supreme Court may indicate to be necessary? In any case the Federal Government must be a party at least to the administration of such international streams as Rio Grande, Colorado River and Milk River.

Effect of High Temperature Fire on Concrete Building

Burning Naphthalin Fuses Concrete and Wrecks Structure of Barrett Mfg. Co. at Frankford, Pa.—Greatest Damage Due to Collapse of Steel Monitors

LAST June a reinforced-concrete building in the chemical plant of the Barrett Manufacturing Co., at Frankford, near Philadelphia, Pa., was wrecked by a high-temperature fire from burning naphthalin, a coal-tar product being stored in the building. Since then the owner has been studying the design of the structure, with a view to its rebuilding, and has preferred



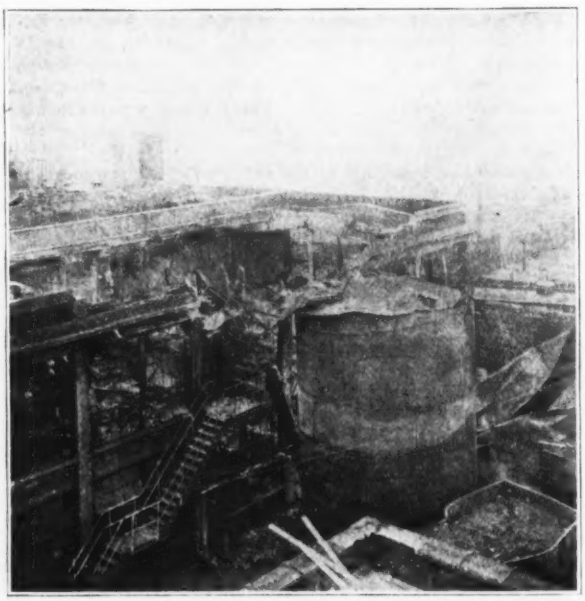
LAYOUT OF PLANT WHERE FIRE OCCURRED

to withhold the details of the fire until some decision could be reached as to the proper design for such occupancy It has now, however, released the following information regarding the building and fire. Part of this information was obtained in an inspection of the building last summer and part from papers read before the recent annual meeting of the American Concrete Institute.

The building in question was a two-story reinforced-concrete structure, 86 x 106 ft. in plan, and divided into two symmetrical parts by a 13-in. brick wall the long way of the building. The first floor was on the ground, and the second consisted merely of beams and girders with no floor slabs. This peculiar construction is due to the occupancy, that is, the cooling of naphthalin. The naphthalin is stored in large, flat pans resting directly on the beams and girders and at intermediate levels at each floor on wooden horses or trestles. The entire structure was of reinforced concrete, except two light monitor roofs, as shown in the cross-section herewith, of unprotected structural steel. The details of the reinforced-concrete design are shown in the accompanying drawings. The columns are square, 18 x 18 in. in the first floor and 12 x 12 in. in the second, and are reinforced with straight rods bound at 12-in. centers by light wire binders. The beams and girders are reinforced by a loose rod system, heavily stirruped and with continuity rods extending well into girders and through the columns. Details of the roof itself are not available, but the structural steelwork is open to the second floor except at the monitors where there was a 3½-in. slab as shown over a part of the sloping roof between the monitors.

On one side of the building about 20 ft. distant from the wire-glass windows were two steel tanks in which naphthalin was stored. The fire started early in the morning and was apparently due to a "boil over" in one of these tanks. The molten material ran out into the yard of the plant and about 150 ft. distant into the boiler room, where it caught on fire and the fire ran back over the surfac of the liberated naphthalin and soon distributed the flames to the naphthalin pans inside the building. The plant watchman was notified of the fire at 5:55 a.m., the naphthalin from the exploded tank being on the ground burning at that time. At 6:30 a.m. the destruction of the building was practically complete; that is, the building was brought to its final failure in about 45 min., which is an indication of the quickness and severity of the fire.

Due to the extreme heat generated by the flames there is very little reputable testimony as to the behavior of the structure during the conflagration. It is to be noted, however, that the steel monitors collapsed almost immediately the fire started inside the building, and, except for a portion of the building as shown on the plan, they carried down with them in their fall the full second story of the building. The fire also attacked the monitor farthest from the tank and that

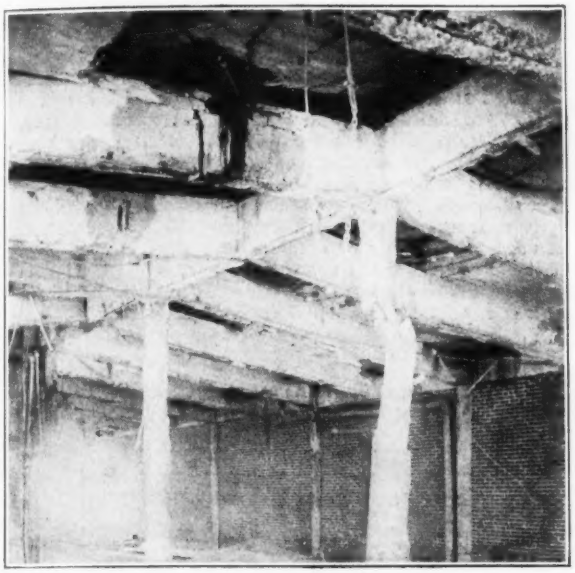


LOOKING OVER TANKS TOWARD WRECKED BUILDING. COLLAPSED MONITOR AND ROOF

collapsed, causing destruction on the second floor of the section beyond the fire wall. Naturally, the heat was most intense in the section exposed to the tank and here the destruction of the concrete itself was most marked. On the side toward the tank, for instance, there is obvious evidence of fusion of the concrete, as shown in the accompanying view. There can be no

question that the temperature at this place reached such a height as to cause fusion. In all previous fires, it may be noted, such an occurrence has been very rare. The steel mullions to the window frames here also melted and ran down the frames in places.

The typical failures are shown in some of the views. The columns spalled off on the corners, the reinforcement softened and bent and the columns cracked as shown. The edges of the beams also spalled, exposing the steel, which softened, bent and in some cases broke, dropping the beams. It is difficult to tell how much of the failure was due to the impact of the falling monitor and how much to direct fire damage.



TYPICAL FAILURE IN SECOND FLOOR

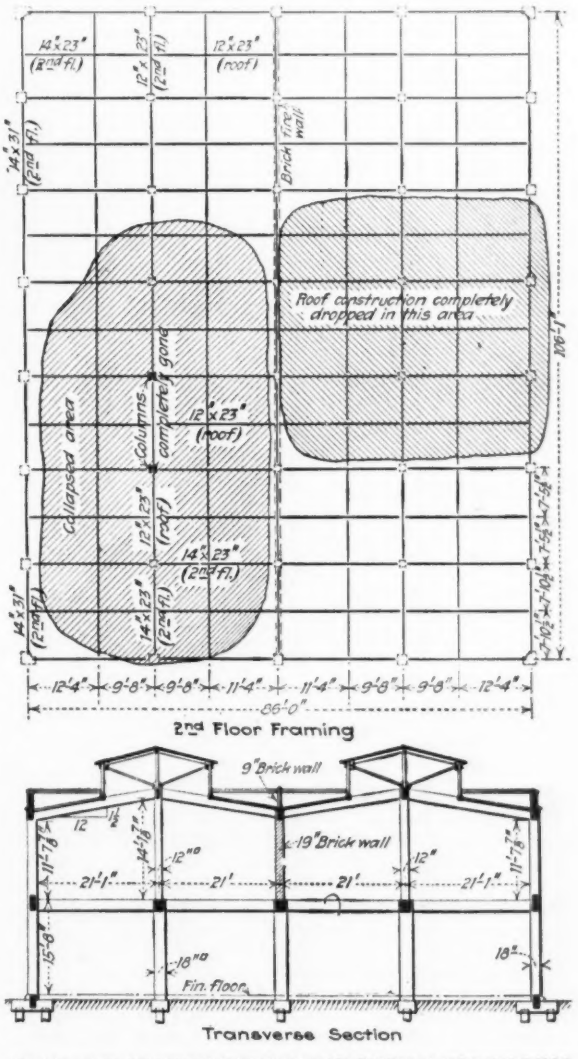
Some of the comments on the design of the building and on the probable design of another building for the same occupancy are taken, as follows, from a paper by W. A. Hull of the U. S. Bureau of Standards:

The building was of modern design and recent construction. It may be regarded as a first-class reinforced-concrete building. However, in connection with the failure of the columns supporting the roof structure, attention should be called to the fact that computation shows that the unit stress on the concrete core of these columns, when a deduction of 2 in. all round is made for fire protection, is somewhat in excess of that ordinarily allowed in engineering practice. Assuming continuous beam action, which probably approximated the true condition, the reactions at the center support are increased by 25 per cent. It should also be taken into consideration that the interior columns presumably expanded more than the wall supports when subjected to fire conditions and that this would still further increase the load sustained by these columns. All of the loads allowed for in computing the stress on the concrete in these columns, with the exception of approximately 15 per cent (the roof live load) were due to the weight of the structure and were actually on the columns at the time of the fire.

The center roof girder was designed with the assumption that it would be fully continuous, which perhaps represented the actual condition except in the end spans for which no details are shown. The roof beams were designed for a bending moment of $\frac{1}{10}$ WL which is ordinary practice for continuous beams of two spans. The maximum diagonal shearing stress in both beams and girders was about 60 lb. per square inch, and what would be considered adequate additional web resistance was provided in the form of bent-up bars and light stirrups.

The coarse aggregate used in the concrete was gravel obtained from the Delaware River near Bridesburg. There was nothing extraordinary about this aggregate; it would properly be classed as a highly siliceous rather than a limestone gravel.

The failure of this building to withstand the attack of the fire presented the engineers of the Barrett company with a new problem, or rather with a series of new problems, for they had to consider not only the reconstruction of this building but also the question of safeguarding other buildings, already in use, in which unusual fire hazards exist. This building had been built according to good practice in design and construction and was regarded as the last word in fire-resistive construction, yet it had failed to resist the attack of a severe fire. It is needless to say that the owners of this building expect to be able to prevent a recurrence of such a fire in the new building but they realize that they



PLAN AND SECTION THROUGH NAPHTHALIN BUILDING WHICH BURNED

have a hazardous occupancy and that there is the possibility of another fire in spite of all precautions. The question of how to build at reasonable cost a building that would be able to withstand such a fire had to be answered.

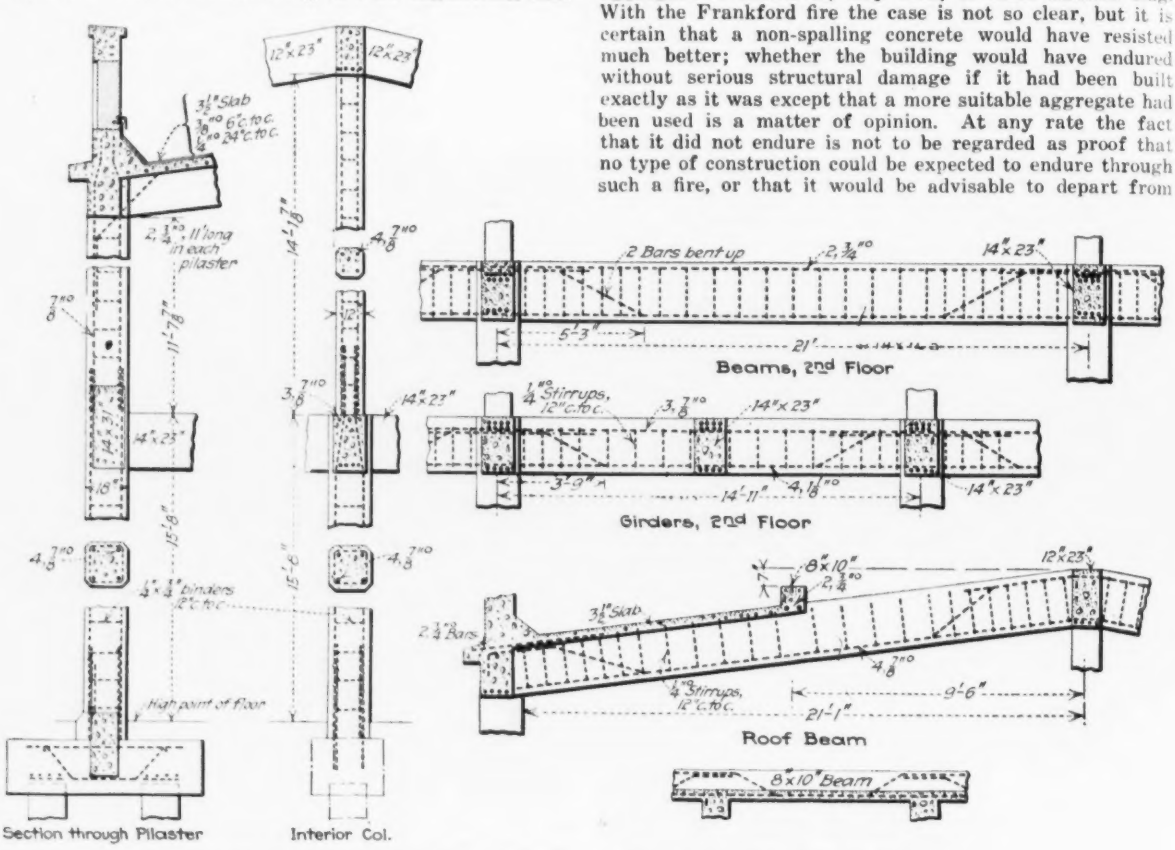
Many things were considered. The advisability of rebuilding in concrete was seriously questioned. Such expedients as substituting brick piers for concrete columns and of protecting the concrete structural members with

burned clay in some form were considered. It was a case that could not be disposed of by saying that nothing could be expected to withstand such a fire. If the best concrete construction were not going to be suitable it was obviously necessary to try to find something else that would. However, a careful analysis of the matter brought out the fact, very strikingly, that the building that was damaged, although first-class in every other respect, was absolutely unsuited to the resistance of a quick, sharp fire, and that the results did not differ widely from what was to be expected of this type of structure. The fact was also brought out that the failure of this building did not justify the conclusion that concrete construction is not suitable for such an occupancy.

It is the writer's understanding that the engineering staff of the Barrett company decided to rebuild in concrete, although because of prevailing business conditions the structure has not yet been replaced. It may be worth while, however, to review some of the points which led to the conclusion to rebuild in concrete.

As has already been stated, this building, first-class in other respects, was by no means of the best type of fire-resistive construction that can be built, within reasonable cost limits, of reinforced concrete. In the first place, the gravel aggregate used in this building belongs in the class of aggregates that have a strong tendency to spall when exposed to quick fires. The square columns and rectangular girders made spalling relatively easy. There was, of course, nothing provided, in the way of metal mesh or other tie, to prevent the loss of the protective concrete by spalling. It has been demonstrated repeatedly, by actual fires and by fire tests, both in this country and in England, that this type of concrete building does not resist quick, hot fires well. This is the second notable case in which such construction has failed after a comparatively short exposure. There have been a number of other cases which have been less spectacular and have received little if any publicity.

In the case of the Far Rockaway fire and of the one at Frankford the process of destruction was essentially the same. Large portions of the outer protective concrete spalled off, leaving the load bearing concrete and portions of the reinforcement exposed directly to the fire. Neither steel nor load bearing concrete is adapted to withstanding such exposure, and this is particularly true of concrete made from a highly siliceous aggregate. In the case of the Far Rockaway fire it seems reasonably certain that had the building been identical in all respects except aggregate with the building that was so badly demaged it would have come through the fire without structural injury. In this case the same construction would have "got by" if the concrete had been of a non-spalling type made with a coarse aggregate of limestone, trap rock, or blast furnace slag. With the Frankford fire the case is not so clear, but it is certain that a non-spalling concrete would have resisted much better; whether the building would have endured without serious structural damage if it had been built exactly as it was except that a more suitable aggregate had been used is a matter of opinion. At any rate the fact that it did not endure is not to be regarded as proof that no type of construction could be expected to endure through such a fire, or that it would be advisable to depart from reinforced-concrete construction in building to house such an occupancy. The type of construction as well as the aggregate was poorly adapted to resist spalling and other structural damage. The long, slender, square columns and long girders without special ties for the protective concrete made the building particularly liable to such effects.

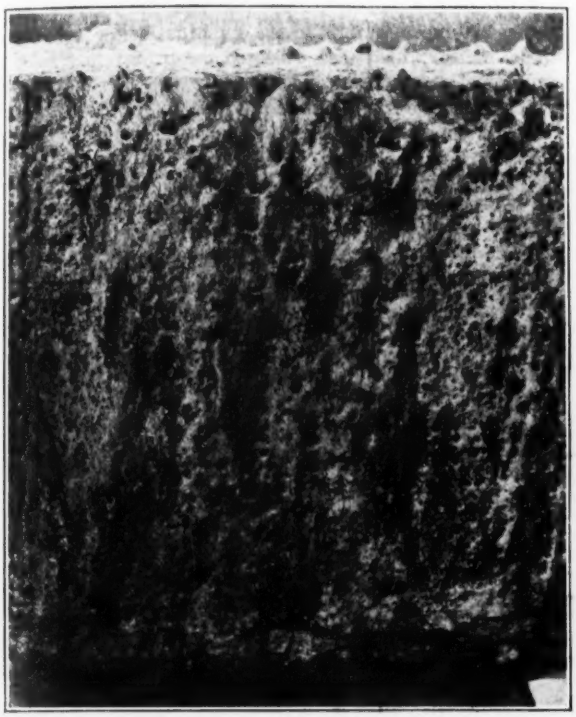


DETAILS OF REINFORCED-CONCRETE FRAMING IN WRECKED BUILDING

In many localities a non-spalling aggregate can be used without excessively increasing the cost of the building. Limestone, either crushed or in the form of limestone gravel, as well as trap rock and blast furnace slag are all so definitely superior to siliceous gravels, crushed sandstone and crushed granite as to make two distinct classes of aggregates, which for brevity have been called spalling and non-spalling. Where the cost of a non-spalling aggregate is excessive the severe fire hazard can be met by the use of secondary reinforcement in the outer concrete together with a reasonable increase in the thickness of the latter. The effectiveness of secondary reinforcement in the form of a light grade of expanded metal placed in the protective concrete has been tried out in fire tests of full sized building columns with promising results. There appears to be no reason for doubting that the fire-resistance of girders and

slabs made from the spalling types of aggregate could be brought up to any reasonable standard by the proper use of secondary reinforcement with protective concrete of suitable thickness.

The lessons to be learned from the Barrett fire seem to be fairly well defined. If we accept the evidence of the column tests that have been conducted within the last three years at Chicago and at Pittsburgh there can be no doubt



A SPECIMEN OF FUSED CONCRETE BEAM

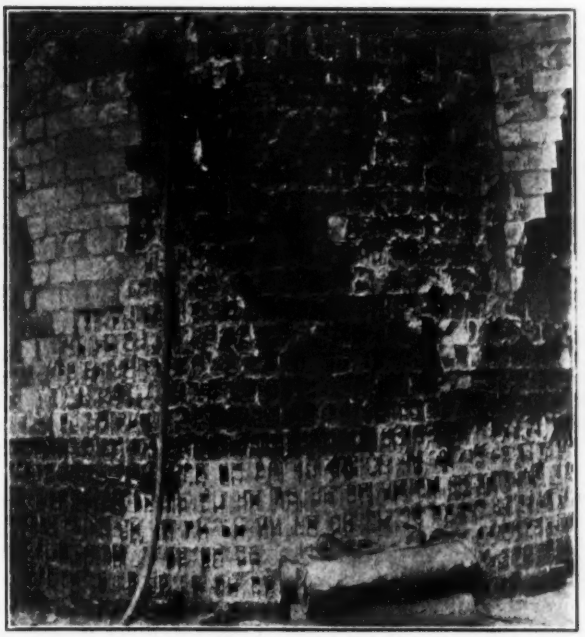
that reinforced-concrete buildings that will be very greatly superior to the Barrett building in point of fire-resistance can be built without too radical departures from established engineering practice.

In the report of the committee on the Far Rockaway fire, of the American Concrete Institute, is the following comment on the Barrett fire.

The progress of the fire was extremely rapid. At the beginning, Tank 79 was burning; Tank 80, having a wooden top, soon caught fire and was entirely consumed. The fire spread to Building No. 15, known as the "Pan House," where the material, in Section A (east of the dotted line, which represents a temporary wooden partition), lay in long cooling pans. West of this partition was the "flake house," where the material existed in a flocculent condition and was spread over the roof, beams and sides of walls. In addition to Tank No. 79, Building No. 17, the coal storage, the roof of Building No. 6 and the awnings on Building No. 5 were ablaze at the start.

In Section B, the second tier columns were all damaged, and will probably have to be removed. Section C is in pretty fair condition. Section D, known as the centrifugal room, was only slightly damaged. The fire wall separating these three sections from Section A probably protected sections B, C and D from damage. The shipping platform was destroyed, as was also the hose house in front of Building No. 2. The hollow radial brick stack of the boiler house was damaged to a height of about 30 ft. Considerable spalling took place and it was necessary to plaster the stack for a distance of 30 ft. from the ground. Building No. 17 was entirely destroyed, and the roof of Building No. 6 was seriously damaged.

The very rapid and intense heat that resulted from the burning of this naphthalin, especially in Building No. 15, which had no floors, but had a double tier of long, cooling pans, containing naphthalin, which burned freely, subjected the concrete to very rapid expansion, and caused the serious spalling of the corners of the columns and edges of beams, exposing the reinforcement in nearly all cases and in one of the columns the exposure was sufficient to cause buckling of the column. The rigidity, however, of the roof construction was sufficient even under this severe treatment to keep it in place, excepting the western end of Section A. Failure was caused by the collapse of the unprotected metal lantern. The north end of the building, facing Tanks No. 79 and 80, was subjected to very unusual heat and the face of the brick walls spalled under the action of this heat for the distance of nearly an inch. The wired glass in the windows melted and even the metal mullions were melted. The flames from the burning naphthalin in the cooling tanks roared through this opening and fused the adjacent concrete faces of the beams and girders even on the exterior of the columns. The columns in this building were square in section and spalling occurred. The round type of column would have materially helped the situation, but in the judgment of the committee would not entirely have prevented spalling.



CONDITION OF BRICKWORK IN STACK LOCATED ABOUT 100 FT. FROM FIRE

From this fire are drawn the following conclusions:

(a) The spalling of the concrete was in a large measure due to the use of a coarse aggregate which contained a large percentage of quartz;

(b) Square columns increased the degree of spalling;

(c) Structural concrete requires protection against fire; the thickness of the protective coating depends on the degree of heat to which the structure is likely to be subjected;

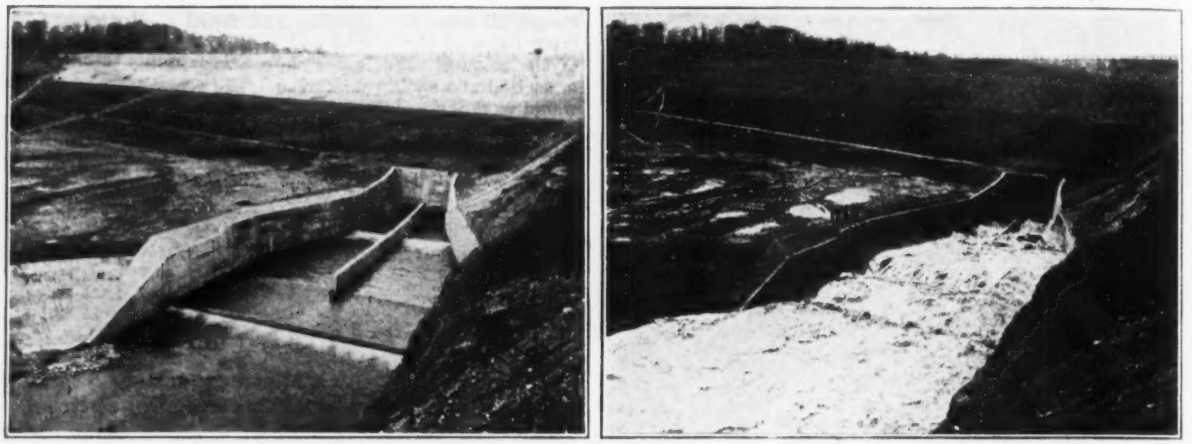
(d) It is probable under these conditions that 2½ in. of concrete, made of aggregate of non-spalling character and properly reinforced, would afford adequate protection to the structural concrete;

(e) The sprinkler system was rendered inefficient by the shutting off of the electric current which operated the pumps;

(f) The engineers of the Barrett company are of the opinion that there is no more suitable material for use under such conditions than reinforced concrete, and will, therefore, use this material in reconstruction.

Hydraulic-Jump Pools Effective

RECENT observations of the functioning of the hydraulic-jump stilling works at the outlet of the Germantown dam, near Dayton, Ohio, show that the design of outlet works adopted by the Miami Conservancy District for its detaining dams is entirely effective, the functioning being precisely that expected from the model experiments and intended by the designers. Last season, the dam being then uncompleted, the outlet conduits were of twice their ultimate depth, being so built in order to provide excess discharge capacity as a safety measure against overtopping of the unfinished embankment. Late last year, however, the lower half of the conduits was filled and the permanent conduit floor placed over the filling, thereby increasing the throttling effect of the conduits and allowing the dam to function in full as a detention dam. A test of the design of the outlet works therefore was not available until the present stage.



HYDRAULIC JUMP IN DISCHARGE OF GERMANTOWN DAM OUTLET CONDUITS AT LOW AND HIGH HEADS

Permanent floor of outlet conduits in place. Left-hand view taken March 4, at ordinary low water. Right-hand view taken March 9 during a freshet, when the dam was impounding water; conduits discharging under about 16-ft. head.

In the view at the left herewith is seen the discharge at relatively low flow of the stream (Twin Creek). The view was taken March 5. A distinct hydraulic jump is seen at the entrance to the stilling pool, and the flow over the tail weir is smooth and evenly distributed. The much more pronounced and powerful jump occurring under higher velocity flow is exhibited by the right-hand view, taken on March 9, during a sharp freshet, when the dam ponded the steam flow to a depth of 16 ft. above the crown of the conduits. The view very clearly portrays the effectiveness of the jump pool in transforming the high velocity concentrated flow of the conduits into the slower tailrace flow.

Rule of the Pavement in London

The London traffic committee, appointed by the Ministry of Transport, has been discussing the question of a rule of the pavement and has favored the rule of "Keep to the left" to correspond with the rule of the road. As it is, most pedestrians in London follow an unwritten law of the pavement of "Keep to the right," with the result that pedestrians walk with their backs to approaching traffic; many accidents have resulted from pedestrians stepping off the pavement into the road to allow more room and being run down.

Shield vs. Trench Method for Hudson Vehicle Tubes

Chief Engineer Holland Answers Arguments of Olaf Hoff Regarding Type of Construction Decided Upon

QUOTING from his annual report for 1920, C. M. Holland, chief engineer of the New York-New Jersey Tunnel Commissions, explains below why the shield method has been selected in preference to the trench method for the construction of the Hudson River vehicular tunnels between New York and New Jersey. The reasons which influenced the decision of the commissions are given in reply to a communication received by *Engineering News-Record* from Olaf Hoff, advocate of the trench method and builder of the Detroit and Harlem River tunnels. There are printed below Mr. Hoff's letter and a reply thereto in the form of excerpts from Mr. Holland's latest annual report. Mr. Hoff says:

In your issue of March 31, p. 562, there is an article headed "Hudson River Vehicular Contracts to be Ready May 15." The statement is made in this article that it is definitely announced in Mr. Holland's report, "that the trench method of construction which had been under consideration as an alternative during the past year has been abandoned on the ground of not being adapted to the Hudson River conditions." I do not have the slightest desire to criticise the decision of the board of consulting engineers or the chief engineer, but I feel strongly that this opinion should not go unchallenged. The Hudson River conditions in my judgment are, if anything, more favorable to the construction of a trench tunnel than to a compressed air, shield-driven tunnel of the proposed dimensions.

Arguments for Trench Tunnel

My reasons for this statement are as follows:

1. The dredging of a trench in the bottom of the river is a simple, direct and common operation. The side slopes of the trench will probably stand at 1½ to 1, and quite possibly at 1 to 1, for the length of time required for construction purposes.

2. The preconstructed steel section used in the Hoff method, say 300 ft. in length, can be spotted, sunk and aligned in correct position in four hours or less and encased in concrete in not to exceed three weeks.

3. If piles be desired underneath the tunnel to give it an assured stability, rather than depending on the bearing capacity of the silt, they can readily be driven to an approx-

imately correct level and would not need to be cut off. The load being light, on account of the buoyancy of the tunnel, a relatively small amount of piling would be required.

4. In doing this work it would never be necessary to occupy a river space more than 600 ft. in length, along the axis of the tunnel; this certainly should not materially interfere with the traffic of the port. At Detroit we had ore steamers in the height of the summer season passing by as often as every 10 min. and this traffic was never interfered with in the slightest. The Detroit River is much narrower than the Hudson.

5. On the other hand, the driving of the proposed two river tubes of the unprecedented diameter of 29 ft. in the Hudson River silt by shield and compressed air will unquestionably present the gravest difficulties with a constant menace of accidents.

My opinion in this matter is based on my practical experience in carrying to successful completion, under the Hoff method, two of such trench tunnels. The Detroit River tunnel and the Harlem River tunnel of the Lexington Ave. subway are the most notable examples of successful trench tunnel work, and both of these were built under contract by the writer and his associates. A trench built tunnel has the following advantages over a shield driven tunnel for this project:

1. It can be built far more economically; a saving of several million dollars would not appear unreasonable.

2. It can be built with greater confidence and less risk of accidents.

3. It can be placed at a considerably higher level, thus saving in grades and energy.

4. It will, at less cost, produce a stronger and more substantial tunnel construction, because of the fact that the cost of the materials entering into the construction roughly amounts to about two-thirds of the total, the labor being one-third, while in the shield-driven tunnel it is just the opposite, two-thirds of the cost being represented by labor and one-third by the material.

5. It can be built with auxiliary and separate tubes for the purposes of ventilation, without great additional cost. These could be placed one above the other between the main tubes and used, one for exhausting foul air and the other for forcing in fresh. They could be of a diameter to give about twice the area of the available space left for ventilation in the present plan; this would reduce the velocity of the air in proportion and the cost of ventilation to a still greater degree.

This last item (5) is perhaps the most important, because the problem of an effective ventilation is, after all, the most difficult one to solve in connection with the vehicular tunnel. What will happen if the tunnel is filled with automobiles and trucks and one of them takes fire, say in the middle of the tunnel? That is the outstanding problem that stares the commissioners and the engineers in the face.

The writer has given this matter a great deal of thought and would suggest for consideration that series of segmental bulkheads or partitions be placed crosswise of the tunnel a suitable distance apart (perhaps about 200 ft.) and extending from the roof down to the clearance line. These bulkheads will, if not confine the smoke, at least greatly interfere with its spread throughout the length of the tunnel. An asbestos curtain, either wound up on a roller or placed horizontally and passed over a roller, could be placed along the lower edge of these partitions and lowered to the roadway; shutting off a limited space in front and rear of the burning vehicle from the remainder of the tunnel.

It seems to the writer that such an arrangement at least might afford sufficient time to get the tunnel cleared of vehicles and passengers and thus minimize the chance of a holocaust. Separate tubes for ventilation, however, would appear to be necessary.

In answer to the foregoing, the following excerpts are reprinted from the 1920 annual report of C. M. Holland, chief engineer, New York-New Jersey Tunnel Commissions:

In adopting any type of construction it is necessary to give consideration to the physical features not only of the under-river portion of the work but also of the tunnel approaches. On the New York side of the river the line of the tunnel passes under the slip between Piers 34 and 35, and on the New Jersey side it passes under the slip between Piers 8 and 9 of the Erie Railroad Co. The damages would be excessive if the trench method were used, due to the interference with the waterfront.

In Jersey City, the approach to the waterfront lies under the property of the Erie Railroad Co. which insists that the work must be conducted so as not to interfere with the operation of the railroad yard, and in New York City every effort must be made to avoid interference with the use of the streets by the public. Accordingly, the shield method was adopted as the most practicable, insuring the least inconvenience and the greatest safety to the public.

With the adoption of the shield method of construction from the land shafts to the river bulkhead, the adoption of the trench method as an alternative type of construction under the river was given most careful consideration. Noteworthy examples of the trench tunnel are those constructed under the Detroit and the Harlem Rivers. In studying the trench method of construction under the Hudson River, consideration was given to the wide variance in conditions in the Detroit and Harlem Rivers, on the one hand, and the Hudson River on the other. Attention is called to the decision of the Public Service Commission as to the method of construction used in building the recent subway tunnels under the East River. The commission had already adopted the trench method of construction for the Harlem River tunnel and the same method was considered for the East River crossings, but conditions were so essentially different in the East River from those in the Harlem River that shields were favored for the East River work. In comparing tunneling conditions in the Harlem River, the East River and the Hudson River, it is evident from the width of the River, the great volume of river traffic, waterfront conditions, and conditions of the river bed that, of these rivers, the Hudson River is most suited to shield tunneling. Consequently, if shield tunnels were chosen for the East River in preference to the trench tunnel, as built in the Harlem River, so much greater reason would there be for using the shield tunnel in the Hudson River.

The waterfront conditions in the Detroit and Harlem Rivers are favorable to the trench method of construction in that there are no valuable piers serving large shipping interests; whereas, on both sides of the Hudson River there are valuable piers and waterfront property, interference with the use of which would be an important element of cost which is not nearly so important in the case of shield tunneling, as the work is conducted in such manner as to offier the least interference with waterfront conditions.

Waterway conditions on the Detroit and Harlem Rivers, both as to channel and cross-river traffic, are not comparable with Hudson River conditions, and if a tunnel construction unit of sufficient length for proper prosecution of the work were used in the excavation of a trench across the Hudson River there would be an unavoidable interference with a great volume of river traffic. A count of river traffic shows that 1,500 boats cross the line of the tunnel daily. Congested river conditions, while serious to the river traffic, are also of importance in estimating the cost of the trench method because of the hazards to the equipment of construction as well as to shipping itself.

The records of the U. S. Engineer Office for the Port of New York, during the years 1918 and 1919, show that two dredging outfits, working under the direction of that office in the East River where conditions are not as bad as in the Hudson River, suffered 62 accidents, 5 of which caused delays varying from 5½ to 46 days. Col. Edward Burr, U. S. Engineer Officer in charge of the New York district, in discussing Hudson River conditions before the American Society of Civil Engineers in October of this year, made a statement which bears directly upon waterway conditions which would have to be met during the construction of the tunnel by the trench method. He stated: "Every dredge or other machine working at a fixed position in a channel is an obstruction to traffic, which is greatly increased if

moorings are necessary, as in swift tidal currents, and the congestion existing in the main channels of New York Harbor, complicated by tidal conditions, creates a most serious problem in the prosecution of operations requiring the use of such machines. Collisions are frequent under these conditions, with resulting increases in the time and cost of prosecuting the work."

From the preceding it would appear that there is a real hazard involved in carrying on operations from plant anchored in mid-stream. Any collision resulting in the sinking of a tunnel section during the operation of placing it in position would be a very serious matter. The shield method of construction will not interfere with river traffic, and therefore no element of cost or damage from that source need be considered. Further, the U. S. Government has placed very rigorous limitations upon the occupancy of the waters of the Hudson River which require the States to bear the cost of dredging a 1,000 ft. channel in the middle of the stream before the trench tunnel could be constructed in the present channel near the New York pierhead line.

The character of the river bed is an important element in the consideration of the practicability of the trench tunnel. The material in the Detroit River is a clay of a consistency that is particularly suited to trench excavation, while in the Harlem River the material is sand and gravel. In the Hudson River the material is a soft silt and rock, the character of the former being such that the volume of excavation that would have to be handled would be unduly large. As to the rock excavation, it would be necessary to blast and remove the debris at a great depth, which condition was not found in either the Detroit tunnel or Harlem River tunnel. This element of rock, in itself unprecedented, is a serious obstacle. This point was given the most careful consideration at the time the decision in favor of the shield method was made for the construction of the East River tunnels through rock and quicksand. Silt conditions in the Hudson River are extremely favorable to the shield method of tunneling in that if the silt cannot be shoved aside by the shields it is easily excavated and disposed of through the tunnel. The very condition of the river bed which constitutes a serious difficulty in the trench tunnel is the one most favorable to the shield tunnel.

It has been claimed that the trench tunnel would effect a substantial saving in cost over the shield method of construction, based largely upon what has been accomplished in other places or upon proposed innovations in this method of construction. It is to be noted, however, that on account of the uncertainty in regard to dredging the Hudson River silt and the removal of the rock in an open trench the general attitude of men familiar with dredging conditions has been that this work should be done under some form of cost-plus or by the rental of dredging equipment rather than upon a straight bid price for yardage in place. The uncertainties of this work, which is of such great magnitude, might involve the contractor in financial difficulties if he bid anywhere near what would ordinarily be considered a fair unit price.

The estimates which have been made do not support the contention that the trench tunnel is the cheaper of the two methods, and attention is called to the actual bid figures on two recent tunnels representing the two types of construction. In 1912 the Public Service Commission accepted bids for the trench tunnel in the Harlem River amounting to $375 per lineal foot of track as compared with bids in 1914 for shield driven tunnels in the East River varying from $388 to $425 per lineal foot. The later prices were submitted when the cost of materials was slightly greater than in the former case, and furthermore, the latter tunnels were about one-third in rock, while very little rock was encountered in the Harlem River tunnel. If this comparison were carried farther to the tunnel under the Hudson River, where conditions for shield tunneling are more advantageous than under the East River, a still lower price for the shield tunnel under the same market conditions can be reasonably expected, due allowance being made for the difference in size of tunnel. The above comparison shows that the claims made by the advocates of the trench tunnel are not consistent with the actual cost of work done heretofore.

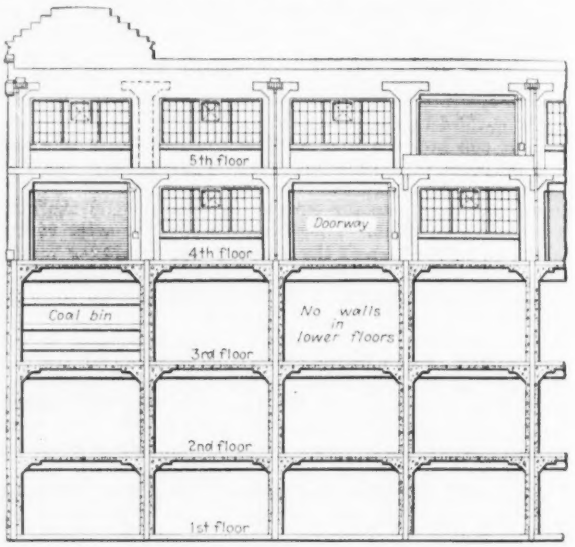
In making a recommendation on these premises important elements must be considered. Counsel has advised that definite plans and specifications must be prepared so that bids will be on a comparative basis and that it is not permissible to ask for bids on general specifications with the privilege of modifying or departing from the engineer's designs.

It is considered that it would be impossible to place a method so untried, so full of possibilities for delays and unusual situations, on a parity with the recommendation which has already been made of the shield-driven tunnel, a type which has been developed along scientific lines through a considerable period of years and which has proved feasible and successful under the very conditions under which this project will be undertaken.

Rail and Water Terminal for Nashville, Tenn.

Lower Floors of River Dock for Wharf or Storage According to Stage of River—Tracks and Mechanical Equipment

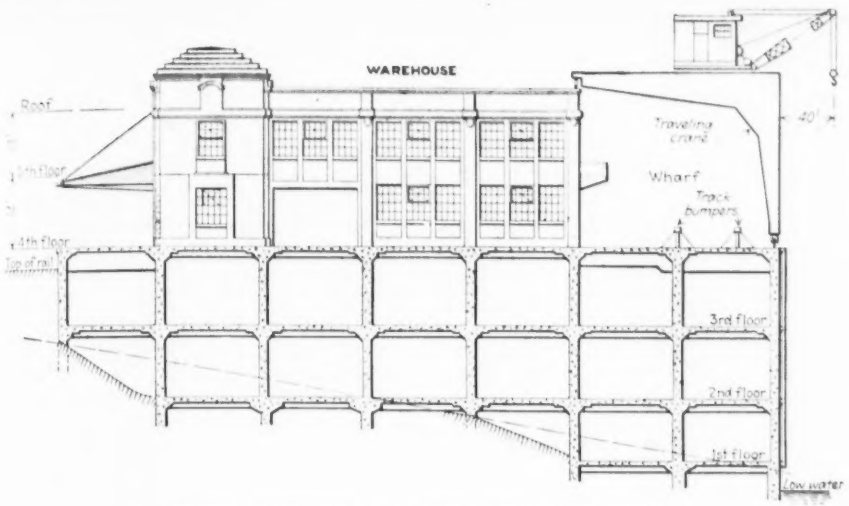
PLANS for a municipal waterfront terminal on the Cumberland River at Nashville, Tenn., for the accommodation of railway and boat traffic and the interchange of freight have been adopted by the Board of Transportation Trustees, which has sold a municipal bond issue of $300,000 for this project. The plans have



PART OF THE RIVER ELEVATION OF DOCK

been approved by the U. S. Engineers for the War Department and it is hoped to put the work under contract this year.

River traffic at Nashville averages two boats daily during the navigation season, but at present the only accommodation consists of the usual levee or paved slope, from which gangways are laid to the steamers or barges. As no wharf boats or floating landings are provided freight cannot be stored in readiness for loading. Therefore when a boat arrives there is frequently a line of trucks and wagons extending for two or three blocks from the levee, the later arrivals sometimes having to stand in line all day before getting a chance to unload. There are few tracks along the bank to permit of handling freight directly between cars and boats. With a maximum variation of 45 ft. in the



SOUTH ELEVATION OF DOCK; NASHVILLE, TENN.

river level, the provision of wharf or dock accommodations available at all stages of the river has been a difficult problem.

A four-story dock so located on the channel as to be accessible for boats at the lowest stage of river and having its first floor 6 ft. above the zero pool level is the solution of the problem as provided in the present plans. The fourth floor is about 4 ft. above the level of the waterfront street, and will have a two-story warehouse. A peculiarity of the structure is that it will have no inclosing walls below the fourth floor, these being prohibited by the government engineers as constituting a serious obstruction to the current during high water. During the greater part of the year these lower floors will be utilized for storage for short periods, protection against theft being provided by city watchmen. A reinforced-concrete coal bin of 100 tons capacity at the outer upstream corner will act as a brace to the columns at the river front.

In plan the dock will be 300 ft. long, with a width of 140 ft. at the third and fourth floors. The other floors decrease in width with the slope of the bank, being 120 ft. and 40 ft. for the second and first floors. The warehouse will be 300 x 80 ft., with a 20-ft. loading platform on the west or land side and the 40-ft. wharf on the river side. A double-track line connecting with the neighboring freight terminal of the Tennessee Central R.R. will be laid in the stret in front of the dock.

On the open part of the river side of the fourth floor will be two stub tracks, with a driveway between them and the warehouse. Along this open part or wharf will travel an electric gantry crane of the semi-portal type, one end of the crane girder or bridge being carried by a leg having wheels traveling on a rail on the floor level, while the other end of the girder is carried by wheels traveling on a rail on the wall of the warehouse. On the crane girder will be a revolving electric hoist with 50-ft. boom and capable of handling a 5-ton load at full reach. The hoisting and traveling speeds will be 100 ft. per minute and the rotating speed 1 r.p.m.

In addition there will be three 5-ton automatic electric platform elevators 10 x 18 ft., each large enough to handle four of the storage battery trucks which will be used for handling freight. These elevators will serve the five floors and will be of the automatic type, with push-button control and micro-leveling device to bring them flush with the floors when stopping. At one end of the building will be an inclined chain conveyor for handling sacked cement or grain between boats and the warehouse or cars. An inclined driveway at one end will give direct access to all floors by trucks and wagons, so that freight can be unloaded in readiness for the boats. Reinforced-concrete construction is to be used throughout, with cylindrical columns supporting a flat slab floor system with four-way reinforcing and having spans 20 x 20 ft. c. to c. of columns. All floors are designed for a live load of 500 lb. per square foot, the wharf or track deck having heavier girders and being designed for Cooper's E-50 loading for the railway tracks. All columns are carried down to footings on solid rock at depths of 8 to 50 ft. below street grade. No special structural features are included. Concrete walls with steel sash and steel rolling doors in alternate bays are used for the warehouse.

The Board of Transportation Trustees is a municipal body which was created in 1917 for the purpose of developing railway terminals and other transportation facilities, with power to build or lease railways and to issue municipal bonds up to $5,000,000. The only issue thus far made consists of the $300,000 bonds sold for the river and rail terminal. Freeland, Roberts & Co., are the consulting engineers for this work, with Russell S. Hart and George Nevins as consulting architects. The cost of the structure and equipment complete is estimated at $350,000.

Tests Disprove Old Theory That Charring Stops Decay

The old theory that charring the butts of fence posts and telephone poles preserves the wood has been disproved by a series of tests recently conducted by the Forest Products Laboratory of the Forest Service, U. S. Department of Agriculture, on fences with charred and untreated posts of varied species. The charred posts proved in these tests to be even less durable than the untreated ones. Theoretically, an area of charred wood around a post should prevent decay, because charcoal does not decay or encourage the growth of fungi. But the charred area around a post is not usually a solid covering. It is checked through in many places. If posts are seasoned before they are charred, the charring does not reach to the bottom of the season checks which are always present. If green unchecked posts are charred, checks will open through the charred part as the wood seasons. In either case the uncharred center of the post is exposed to fungus infection and will decay as rapidly as untreated wood. Charring deep enough to resist decay would undoubtedly weaken a post of ordinary size.

Good Practice and Some Features in Log-Flume Construction

Sound Engineering Often Lacking—"Baby" Flume and Moving Platform Cut Labor Costs—Novel Headgate Gives Even Water Flow

By V. K. Woods
Palmer, Pearson and Woods, Inc., Salt Crescent, Wash.

AS A RULE the building and operation of log flumes is not considered an engineering occupation. The requirements and conditions are apparently so simple that they can be entrusted to practical men. Engineers have at times located flume lines, but have left the building and operation to others. Consequently they have not profited by the errors disclosed in both operation and construction. Flume design, therefore, has shown but little advancement in recent years, while the least contact with operation shows features that would have been changed long since had they come to the attention of engineers.

To those accustomed to the care exercised in the design and location of railroad lines, irrigation canals, etc., the roughness of the location and leveling of the average flume line will prove a surprise. Of course, there is not the reason for the accuracy necessary on railroad or even on ditch work. The traffic is all downhill, the grade of the stream must be approximated and the consequences of frequent and sharp changes in grade theoretically do not appear to be serious. As a matter of fact, however, carelessness in location and design is followed with irregular operation of the flume, the piling up of logs at some points, the throwing of logs out of the flume, and not infrequently, the destruction of considerable trestle.

Fundamental Principles

As to location, it should be a principle to keep the flume as close to the ground as possible. This not only cuts the cost of construction by lessening the amount of trestle work, but makes for greater stability and lessens the cost of rollways (the platforms over which the logs are delivered to the flume). Another error in flume location is a failure to visualize clearly the purpose of flume construction—getting the logs out. As a rule, the flume is built on one side of the valley, near the creek. The gulches coming into the valley terminate in flats, which may be as far as 1,000 ft. from the flume line. Wherever this condition exists it is necessary to put in a trail flume, and, with horses, to haul the logs across the flat to the main flume. To cut down this trail fluming and consequently the cost of operation, it is the writer's practice to swing the flume back and forth across the valley to the mouths of these gulches. In other words, it is better to take the flume to the timber than haul the timber to the flume.

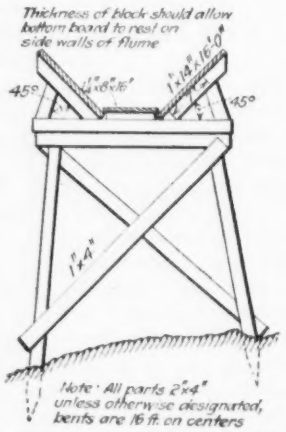

Thickness of block should allow bottom board to rest on side walls of flume
45°
45°
1"×4"
Note: All parts 2"×4" unless otherwise designated, bents are 16 ft. on centers

FIG. 1. END SECTION OF AUXILIARY FLUME

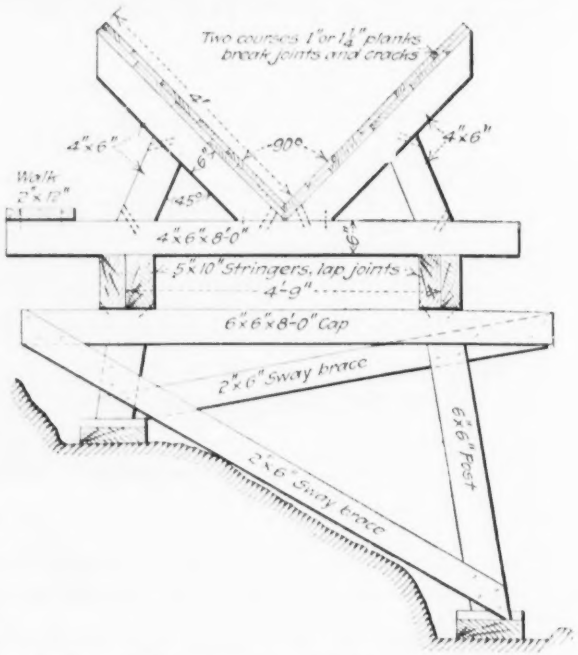


FIG. 2. END SECTION OF FLUME OF HEAVY TYPE

As a consequence of leaving construction entirely to practical men, the grade of the flume is likely to break sharply. As a rule, stakes are put in only at the point of break, the carpenter-foreman then using his eye to "fudge in" the bents so as to secure a vertical curve rather than an angle. Experience shows that these curves are usually too sharp and result in logs sticking at the top in downward breaks, and water piling up or logs being thrown out on upward breaks. Better practice is to put in a grade stake for each bent on vertical curves. The writer's practice is to use a rate of change of 0.01 per cent per 15-ft. bent where the difference in connecting grades is less than 2 per cent. For a difference of from 2 per cent to 5 per cent, the rate of change is 0.02 per cent per bent. Where the grades to be joined differ by more than 5 per cent, the rate of change will be much greater and can be put in safely with the eye. In other words, gradual reversed curves are important chiefly on the flatter stretches of the flume.

In order to secure close adherence to the located alignment and grade, a hub is placed every 15 ft., tacked for center line, marked for the cap cut-off. These hubs are not disturbed, the bents being placed one foot back of them.

For fire protection, as well as to prevent damage to the flume from dead-falls, it is good practice as well as economy in the long run, to clear a 100-ft. right of way.

As to desirable gradients, from 2 to 3½ per cent seems to give best results. Grades as high as 7½ per cent have been used with success. Experience shows that the water in the flume should run within 8 in. of the top.

The maximum curvature depends to some extent on the size of logs to be flumed. For the 5 ft. side flume, the logs should be about from 2 to 4 ft. in diameter and 16 to 24 ft. in length. A maximum curvature of 24 deg. for a 5-ft. side-flume is considered good practice.

The type of flume for heavy work (a flume with 4- or

5-ft. sides) that has proved most satisfactory in the writer's experience is carried on trestle bents 15 ft. on centers. These support stringers 16 ft. long, which in turn carry the V-shaped saddles or brackets, as they are called in flume work. These are spaced on 4-ft. centers on grades under 5 per cent, on 3-ft. centers on grades over 5 per cent and on 2-ft. centers at rollways. Sketches of the standard type of trestle and brackets for a 5-ft. side-flume are shown herewith. Where the flume is at ground elevation the stringers are carried on mudsills. The bents shown in the drawing and the photographs are of sawn lumber. Round timbers cut at the site are frequently used, but prove more economical only on flat ground. On sidehill work sawn lumber flumed down to the site, makes a cheaper job since the round stuff is too heavy to handle economically.

For the flume itself, the most approved type of construction consists of two courses of 1¼-in. stuff. Sixteen-foot lengths are easy to handle and give good results. The widest boards used are 12 in. and those are put in the first course. The limit of 12 in. is fixed because wider boards are difficult to warp on curves. The narrower widths are used in the inner course and care is taken to see that the joints break between the two courses so as to get a watertight job.

Construction Aids

A description of a 5-ft. side flume along Marble Creek, Northern Idaho, presents certain features of flume work that have been the development of a number of jobs. This flume was 18.7 miles long. This work was stopped by the war. The job completed just before this was started was a 10½ in., 4-ft. side flume on Mica Creek, Idaho, designed to carry 1,000,000 ft. of timber in 10 hours, the logs averaging 14 to the 1,000 ft.

In flume construction the standard practice heretofore has been to pack in on horses a saw-mill outfit, taking it to the very head of the proposed flume and then to saw and flume down as needed the necessary lumber for building the trestles, brackets and flume itself. Under this plan of using the main flume for carrying the lumber, it is necessary to carry forward from the end of the completed flume all the trestle, bracket and flume lumber.

An improvement on this method is the use of a "baby" flume, built solely for the transportation of lumber. It has the advantage of delivering material to the spot where it is to be used, thus eliminating the carrying of lumber except for the baby flume itself. Reference to the drawing of the latter will show that the amount of material used in its construction is negligible as compared with that in the main structure. The baby flume is always placed on the uphill side of the main structure,

FIG. 3. FLUME CLOSELY FOLLOWS TOPOGRAPHY

and adjacent to the located line of the latter, for convenience.

Satisfactory shipment of lumber through the baby flume is accomplished through telephonic communication between the man at the receiving end and the shipping clerk at the mill. Thus he is enabled to lay down at each point the exact sticks needed and avoid all handling other than the piling of delivered material. The lumber is removed from the flume by a wooden fork which can be laid on the bottom of the flume to force the lumber up and over the side. The fork has a handle on it so that it can be shifted with ease. While the design of the baby flume is simple, the shape should be noted. A square flume was experimented with, but proved unsatisfactory in operation and was more costly than the section selected.

It is apparent that it is more economical tc put the brackets together before mounting them on the string-

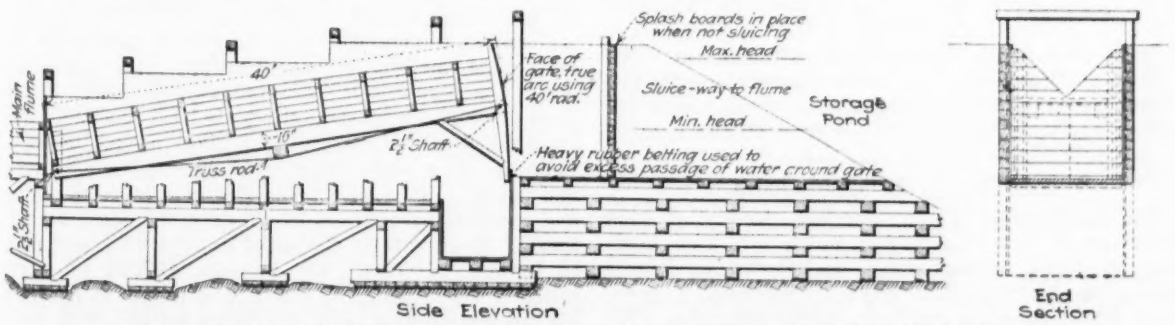


FIG. 4. DETAILS OF SLIDING HEADGATE THAT GIVES EVEN FLOW FROM POND TO FLUME

ers than attempt to assemble them in place. For this reason it has been the custom to carry a work table supported on carpenter's horses along the line. This had to be moved forward at intervals while the lumber had to be carried to it and the assembled brackets carried to the line. On the Marble Creek work an innovation was introduced—a bracket table rolling on the stringers of the completed trestle. Its advantages are obvious. Being located on the flume line, and therefore adjacent to the baby flume, there is no carriage of lumber to it, while carrying of the assembled brackets is also avoided. Moreover, the carrying of the old style table and horses ahead is eliminated. The table is fitted with wooden rollers and is pulled forward by a windlass operated by the two carpenters who assemble and place the brackets. Side rollers under the platform bear against the stringers and guide the table. Mounted on the table is a work bench, on which there is a templet so that each stick of the bracket falls into its proper place without measuring, thus insuring speedy assembling.

FIG. 5. DIVERTING FLUME FOLLOWS RAILROAD SWITCH PRINCIPLE

As a rule, flumes are built near the heads of streams where the water flow is small. In order to get sufficient water to float the logs, a dam is built and the flow stored up for a period of hours, then the gate is opened and a large flow is had for a short time.

In order to maintain an even flow as the water was taken from the pond the writer constructed a gate through which passed a section of the flume. This gate was lowered as the water lowered in the pond, thus making it possible to sluice logs continuously on an even head of water. The gate was constructed with the idea of raising it with a capstan but when operated it was found to raise alone, so the gear was shifted and placed on the lower side of the gate for lowering.

Where local conditions make the sorting or landing of logs necessary, a diverting switch is put in. In operation it is similar to the railroad switch. A hinged lead, or gate, is set at the dividing point of the flumes. This is from 60 ft. to 80 ft. long and is hinged along the line of intersection of the two inside sides of the flumes. By pulleys and windlass it is thrown from side to side.

Am. Soc. C. E. Membership

The membership of the American Society of Civil Engineers on Feb. 10, according to the 1921 Year Book, just published, totalled 9,884, distributed as follows among the several grades: Honorary members, 3; members, 4,243; associate members, 5,025; associates, 174; juniors, 429; fellows, 10.

An Economic Study—

Justifiable Highway Costs

By J. E. Pennybacker
Secretary, The Asphalt Association, New York City

DETERMINATION of justifiable outlay for a proposed highway improvement from anticipated service should call for at least as careful survey and estimate as the engineer now provides for the engineering features preliminary to the construction of the highway. Millions of miles of earth roads and thousands of miles of lightly surfaced and poorly designed gravel and macadam roads impose upon the highway engineers of the nation the task of so parceling out insufficient highway revenue that it will be applied to the highways in proportion as they show traffic justification for improvement.

To incorporate this requirement into highway engineering practice is to make the traffic unit as widely used as the customary units of physical measurement. This measurement of justifiable outlay by the yardstick of traffic does not disregard the profound beneficial influence of the highway upon social life and educational development in rural districts but inasmuch as they go hand in hand with traffic development the latter may in general be regarded as an index of both the direct and indirect value of the improvement.

Motor vehicle traffic predominates to such an extent as to make logical the adoption of a system of measuring costs and justifiable outlay primarily in units derived from this class of traffic. Thus while the unit commonly used for horse drawn traffic is the ton-mile and applies to loads rather than to vehicle it is necessary to adopt a unit which will take into account the eight and quarter million passenger automobiles now registered and the millions to come and which will allow credit to the highway for the saving in their operating costs. To substitute "vehicle-mile" would not fully meet this need as the million trucks in use and those yet to come must be rated as deriving greater benefit individually than the passenger car. A simple plan sufficiently comprehensive to meet most needs is to retain the ton-mile as the unit of measurement, but to regard each passenger car and each one- and two-horse vehicle as the equivalent of 1 ton, while the motor truck and the heavy team outfits would be regarded as the equivalent of the vehicle weight plus the load in tons. This plan would permit of a rapid traffic enumeration without complexity. Subdivision of the investigation to determine whether the route is to be for heavy truck traffic or for light traffic would require segregation of the heavy and light truck records respectively, but this would not affect the main purpose of the investigation, to ascertain justifiable outlay.

Counting the traffic on the old road is manifestly an inadequate method of ascertaining total ton-miles. After the highway is improved it will divert traffic from other highways, will stimulate local traffic so that more miles will be traveled in a given period, increase deliveries from and to market points, develop resources and finally, if it is on a trunk line or a route to scenic and recretational regions, it will draw increased tourist travel. These various classes of anticipated travel may be termed "potential" and however difficult of exact estimate the investigator should give weight to them in his recommendation as to justifiable outlay. It is suggested that for the potential local traffic a zone be

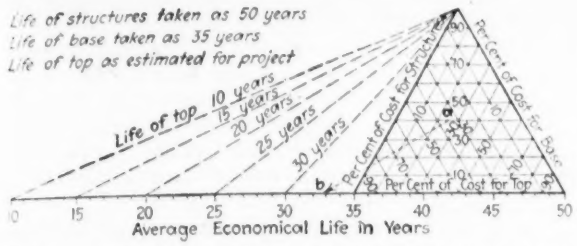

Life of structures taken as 50 years
Life of base taken as 35 years
Life of top as estimated for project
Life of top 10 years
15 years
20 years
25 years
30 years
Per Cent of Cost for Structure
Per Cent of Cost for Base
Per Cent of Cost for Top
Average Economical Life in Years

FIG. 1. AVERAGE ECONOMICAL LIFE OF HIGHWAY GOVERNING TERM OF BOND ISSUE OR INVESTMENT

plotted to include the territory which might logically be served by the highway after improvement. Within this zone the investigator could make an approximate automobile census and so acquaint himself with the business, industrial and social factors and possibilities of the zone as to establish a basis for estimating both the saturation point in motor vehicle ownership and the average mileage per car. In short, without attempting to present here the exact detail of a traffic survey, I do mean to urge the necessity and practicability of a traffic census which covers both existing and potential traffic.

Operating costs of motor vehicles are ascertainable and may be expressed in ton-mile units. Costs of gasoline, oil, tires, repairs and depreciation, garage, chauffeur, taxes, etc., make a substantial total. The average cost per car, if we use 9,250,000 as the number of cars and $5,000,000,000 as the annual cost, would be $540. If the average mileage is 5,000 the cost per car-mile is 10.8 cents. Applied to ton-miles the average would be somewhat lower as the trucks loaded would average 3 tons, thus making it probably 8.9 cents. Whether such a rate per mile is too high or too low on a given highway should be ascertained by the investigator. When he has determined upon the rate, however, and applied it to the potential ton-miles, he has established the gross traffic cost on the highway for potential traffic if no saving were effected.

The cost of operation per ton-mile on the old road should be ascertained and from this should be subtracted the estimated cost of operation per ton-mile on the improved highway established by comparative data of operating costs on highways similar to the type or types under consideration for the improvement. As the traffic cost per ton-mile would be affected by the character of the highway improvement to be adopted it is assumed that the engineer will base his comparison upon a type or types of improvement which appear to him practicable if they can be financed out of the traffic saving. In other words, this method leaves to the engineer the same discretion as he now customarily exercises in selection of design but subjects it to the test of financial justification. This saving in cost of traffic operation per ton-mile, when applied to the total existing and potential increase in ton-miles, gives the *gross annual saving* in traffic operation attributable to the improvement.

The *net annual saving* in traffic operating costs is arrived at by deducting from the *gross annual saving* the increase in the annual highway budget for interest, maintenance and depreciation of the improvement. In order to obtain the annual cost chargeable to interest and depreciation it is necessary to estimate the economical life of the improvement contemplated and take that amount which at the end of the period will have discharged all interest and retired the principal.

Considerations which determine the economical life of the improvement, or the period beyond which it may no longer be maintained as such without prohibitive cost, involve not only a study of the durability of pavements of the various types but also the durability of the foundation and of such improvements as acquirement of right of way, reduction of grades, elimination of curves and grade crossings and installation of permanent structures, etc. If these latter features form a considerable portion of the first cost the term in which traffic saving is expected to pay for the project should be correspondingly lengthened. If, moreover, a pavement such as sheet asphalt or asphaltic concrete is used, it may be renewed at the end of its economical life without, as a rule, incurring any additional expense for foundation. To compare one type of pavement with another as to their durability the important point must not be overlooked that renewal may be extensive or merely the renewal of the surface. The most rational

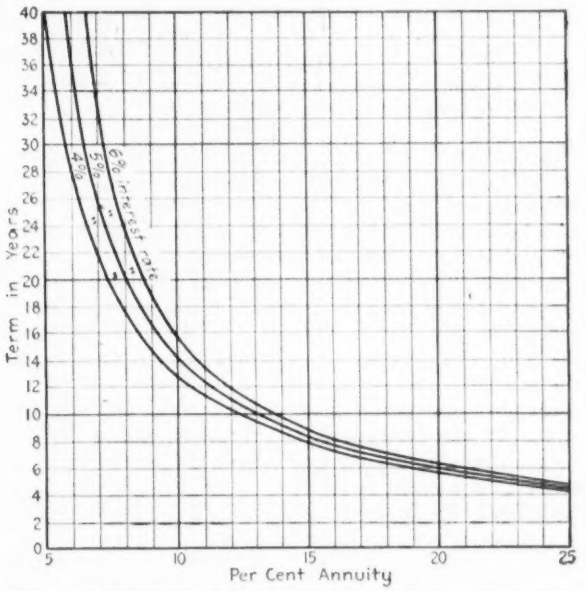


FIG. 2 PER CENT ANNUITY TO RETIRE AN INVESTMENT WITH INTEREST AT VARIOUS RATES

plan is to estimate first the durability and cost of structure etc., as Class 1, foundation as Class 2, and surface or wearing course as Class 3 and obtain a weighted average of durability for the entire project in which the factors would consist of the life and the per cent of cost of each class of improvement. Fig. 1 may be used in determining the economical life of the improvement.

In this chart a life of 50 years is assumed for Class 1, 35 years for Class 2 and from 10 to 30 years for Class 3 improvements. From the point at which the per cent of total cost lines for surface, base, and structure intersect for a given project, an imaginary line is projected paralleling the 10-year line, if the surface is estimated at 10 years; the 20-year line if 20 years, or the 30-year line if 30 years. Intermediate ages can be plotted between these limits. The intersection of the projected line with the base gives the average economical life of the road or investment.

As an example it is ascertained that Class 1 improvements represent 25 per cent, Class 2, 35 per cent and Class 3 40 per cent of the total cost of improvement.

This point is located on the triaxial diagram at *a*. If the estimated life of the wearing course is 20 years a line *a-b* should be drawn parallel with the 20-year line intersecting the base line at *b* which shows an average economical life of 32½ years for the road and also the period in which the investment should be paid off.

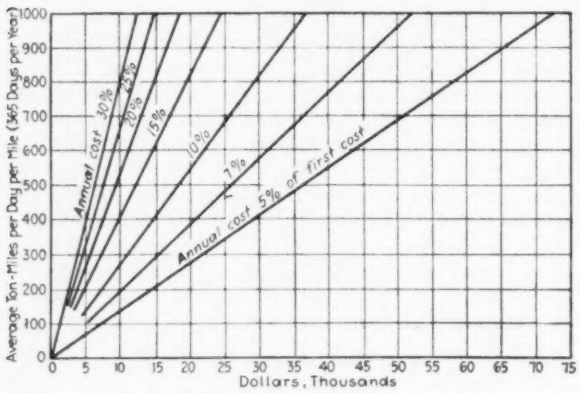


FIG. 3. JUSTIFIABLE FIRST COST OF ROAD PER MILE WITH SAVING OF 1 CENT PER TON-MILE

As the cost of the improvement is logically expressed in the form of annual outlay for interest, depreciation and maintenance, Fig. 2 may conveniently be used to ascertain the annual per cent of first cost required for interest and depreciation over the period covering the economical life of the improvement. The curves are plotted to show interest rates of 4, 5 and 6 per cent; ordinates show terms of years and the abscissæ show per cents of total cost for combined annual interest and depreciation.

Maintenance costs may increase or decrease by reason of the improvement. Whatever the difference between the old and the new costs may be, it should be taken into account by adding to or subtracting from the annuity determined by use of Fig. 2 as illustrated in the example which is given later.

Fig. 3 shows the justifiable first cost at a saving of 1 cent per ton-mile for any number of ton-miles per day up to 1,000 for improvements estimated to require for interest, depreciation and maintenance 5, 7, 10, 15, 20, and 25 per cent respectively of first cost.

To apply the chart assume as an example an 800 average daily ton-mile traffic with a prospective saving of one cent per ton-mile and that the engineer desires that the project be completely paid for in 32½ years. Reference to Fig. 2 shows that with interest at 5 per cent the annual cost is 6.2 per cent of the first cost for interest and retirement. The point in Fig. 3 for this latter per cent with a daily traffic of 800 ton-miles would give $47,000 as justifiable first cost. An adjustment may then be made for maintenance by turning to cost records of the old highway and ascertaining if the annual cost of maintenance is greater or less than that indicated by the estimated annual cost of maintenance for the improved highway. If, for example, the annual cost of maintaing the existing road is $800 per mile and the estimated cost for the new road $300 per mile an annual saving of $500 per mile is indicated. Next should be ascertained what investment is justifiable on account of this saving for the same period and rate of interest previously decided upon. In other words $500 is equal to 6.2 per cent of what sum? This is found to be about $8,000 which added to the $47,000 previously derived gives a total of $55,000 as justifiable first cost.

It may not be amiss to emphasize here the far reaching importance of saving in maintenance cost as justification for improvement in the highway. It is too generally the practice to charge to the improvement the full maintenance cost as well as the full interest on initial cost throughout the entire period.

The practice of proportioning outlay to traffic value of the project will become systematized in time. Preparation and design and selection of type in the light of obtainable traffic data can be made more definite and practical without curtailing the exercise of engineering construction judgment. Rather it will broaden the scope of the engineer. What is apparently needed is a blending of traffic and construction surveys to form a coordinated whole.

Water Purification Plant at Highland Park, Michigan

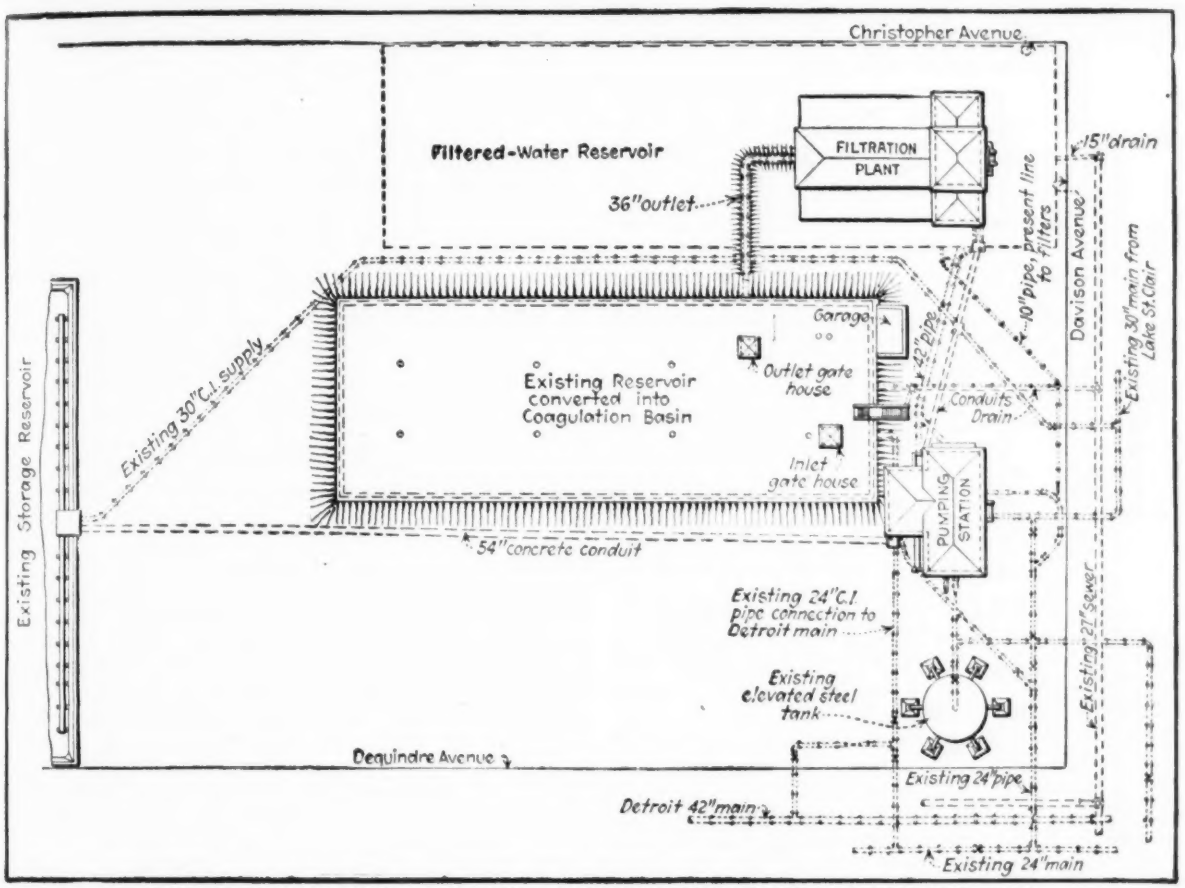
Closely Baffled Coagulation Basin Permits Varying Detention From 20 Minutes to 4 Hours—Perforated Pipe Underdrains

A WATER purification plant has recently been completed for Highland Park, Mich., consisting of a 48,000,000-gal. concrete storage reservoir, a 2,750,000-gal. covered coagulation basin converted from an existing open reservoir, a 12,000,000-gal. daily filtration plant and an electrically operated pumping station. Extreme flexibility is available in the closely baffled coagulant basin. Perforated pipe underdrains in the filters and all of the piping is arranged for rates much in excess of the normal. Pending a reduction in the cost of materials no wash water tank has been installed, a force main being bled to wash the filters. Special arrangements have been made for experimental work with two of the filters.

Water from Lake St. Clair, 11 miles away, is forced by an electric-driven centrifugal pump through a 30-in. main laid around the City of Detroit. The water is delivered into one end of the storage reservoir and taken out of the other, giving a detention period of from three to six days before passing to the coagulation basin. This reservoir was completed in 1917 and described in *Engineering News-Record*, April 11, 1918.

Coagulation Basin—Existing on the site was a storage reservoir 114 ft. wide and 324 ft. long by 13 ft. deep, with side slopes to the earth embankment of 1½ to 1. The bottom is about 5 ft. below the natural ground surface. To convert the reservoir into a coagulation basin a plain concrete groined arch roof was supported on 15-in. square columns and covered with 18 in. of earth. The arches have a span of 14 ft. c. to c. both ways and a rise from spring line to crown of intrados of 3 ft. The heavily reinforced footings are 6 ft. square and rest on the old 4-in. reinforced-concrete floor. The groined arches terminate at the ends and sides in a barrel arch which rests on the old concrete side walls.

A horizontal mixing chamber 14 ft. wide and 64 ft. long, with wooden baffles 3½ ft. apart, was constructed across one end of the basin. At the head of this mixing chamber is a gate house equipped with an automatic float valve to control the flow into the basin and



GENERAL PLAN OF PUMPING STATION AND PURIFICATION WORKS FOR HIGHLAND PARK

to hold the elevation of the water surface constant. A concrete bypass conduit leads from this gate house across the floor of the basin to the outer gate house, so that water can be carried directly to the filtration plant while the coagulation basin is being cleaned.

The basin has numerous baffle walls constructed of one width of common brick so that the water is kept in motion as it passes through the basin. Numerous gates are provided both in the mixing chamber and coagulation basin proper so that the utmost flexibility in the coagulation process can be obtained. A detention period of from 20 min. to 4 hours can be obtained in the basin by the manipulation of the gates when operating at a daily rate of 12,000,000 gallons.

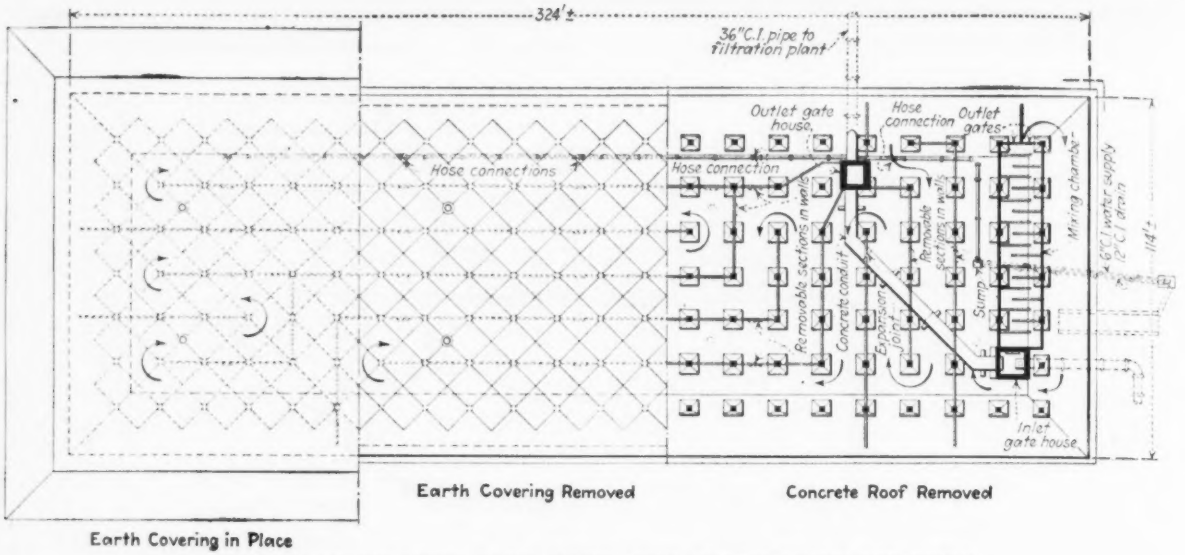
In operation the basin will be supplied from the 48,000,000-gal. storage reservoir, either directly by gravity or through low-lift electrically-driven centrifugal pumps when the reservoir is low. Since the maximum elevation of the water in the storage reservoir is 3½ ft. above that of the coagulation basin a gravity flow can only be obtained when the storage reservoir is kept nearly full of water.

The coagulant used, which is sulphate of alumina, is applied at the entrance to the basin from a hose line run from the head house of the filtration plant. Proportioning is by means of automatically controlled dry chemical feed machines located on the second floor of the head house.

Filtration Plant and Filtered Water Reservoir—The filtration plant consists of twelve filters with a daily capacity of 1,000,000 gal., with a head house, built over and at one end of a 4,000,000-gal. filtered water reservoir. The substructure of the filtration plant is built in such a way that four additional filter units can be added easily when the need arises. While the filter plant is similar to a number of others of this size there are certain features which are distinctive.

The pipe gallery has a clear width of 14 ft. and is so arranged that there is ample room to walk through without climbing over pipes, valves or other equipment. The filtered water conduit consists of a rectangular concrete box supported on piers at such an elevation that its top forms a 5-ft. walkway the entire length of the gallery. The other conduits are cast-iron pipe. All pipes, valves, rate controllers and other equipment are so arranged in the gallery as to give ample head room and working space. A 6-in. cast-iron pipe to carry filtered water to waste when a filter is first started after washing is provided and connects both with the sewer and with a reservoir under the head house, so that it is possible either to run the filtered waste water into the sewer or to store it for use later in washing filters. The rate controllers are of the venturi type and are arranged along the sides of the filtered water conduit into which they discharge. The filtered water conduit is turned up at the outlet end, where it runs into the filtered water reservoir, so that the conduit and rate controllors will at all times be submerged.

The filtering material consists of 30 in. of sand and 18 in. of graded gravel. Part of the sand is from Cape



BAFFLED COAGULATION BASIN MADE FROM EXISTING OPEN RESERVOIR

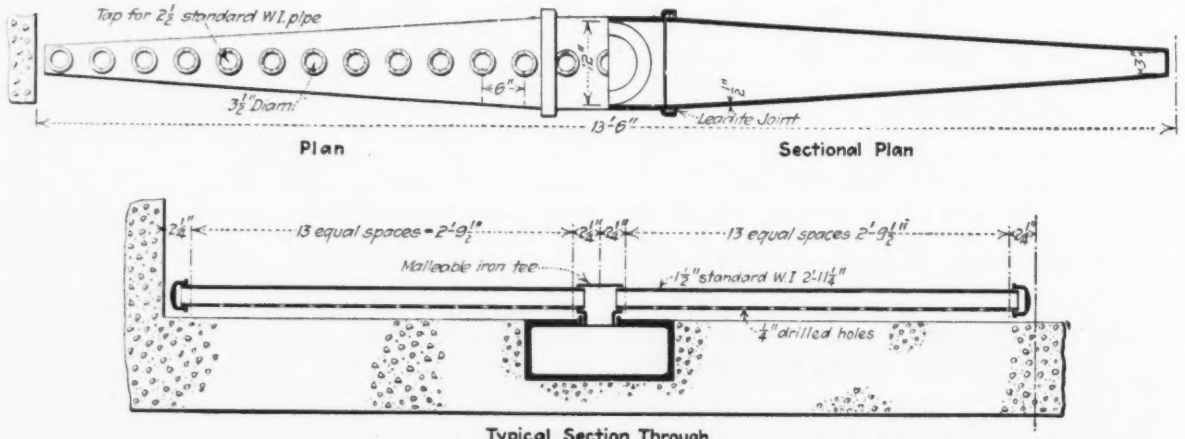
May and part from Red Wing. It has an effective size of from 0.43 to 0.48 mm. and a uniformity coefficient of not more than 1.5. The gravel is from a local bank and was washed, screened and hand picked and then carefully deposited in six layers.

The laterals of the underdrainage system consist of 1½-in. wrought-iron pipes, about 3 ft. long, with ¼-in. holes in the bottom about 2½ in. apart. These pipes are spaced 6 in. c. to c. and at their inner ends are screwed into tees which in turn are screwed into the flat tops of cast-iron manifolds. Each manifold, with its tributary lateral, serves one-quarter of a filter unit. While the filters each have a nominal capacity of 1,000,000 gal. per day, based upon a rating of 125,000,000 gal. per acre per day, it is expected that considerably higher rates may be attained, and piping, underdrain systems and other elements of the plant have been planned accordingly.

installed. In its place a 10-in. connection has been made in a 30-in. force main from the pumping station to the city, and water from this source after passing through a pressure reducing valve is to be used.

Two of the filters have been equipped with special pipes and connections for experimental work, so that large-scale investigations into rates of filtration, methods of control and size and character of filter sand may be undertaken. The experiments are expected to prove of great value in the operation of the plant.

The filtered water reservoir is 121 ft. wide, 415 ft. long and 13 ft. deep from top of floor to crown of groined arch roof. It is built entirely of plain concrete masonry, except that the portion which lies under the filtration plant is reinforced. The groined arches have a span of 14 ft. c. to c. of columns, the same as in the coagulation basin. The same forms were used for both structures. The reservoir has a capacity of 4,000,000



DETAILS OF PERFORATED PIPE UNDERDRAINS

The plant has been designed with the idea of using a motor-driven centrifugal wash-water pump of large enough capacity to wash one filter at a time, no wash-water tank being provided, but on account of the present high cost of pumping machinery this pump has not been

gal. It is built below the level of the ground and is covered by a 24-in. earth fill.

The red brick head house of the plant is three stories high, including the basement, and contains a place for the wash-water pump and other machinery, a large

entrance hall, office, laboratory, toilet rooms with shower bath, chemical storage and feeding rooms and liquid chlorine room. Considerable money has been spent in beautifying the interior of the building in order to make a pleasing impression on visitors to the plant. The entrance hall is trimmed in gum wood, with mahogany finish, has tile floor trimmed with polished marble, ornamental iron stair railings, bubbling fountain, ornamental light fixtures and other features. Broad marble stairs lead up a height of nearly 4 ft. from this entrance hall to the filter gallery, which is furnished with polished marble operating stands and has a background formed by the white enameled brick walls of the filter house. The floor and filter walls are painted concrete.

Pump Capacities

Pumping Station — A small electrically-operated pumping station built in recent years existed on the site of the water-works plant. The superstructure of this building was torn down and a larger red brick building erected. The pumping equipment consists of six 5,000,000-gal. per day motor-driven centrifugal high-pressure pumping units, four of which were in the old station, and two motor-driven centrifugal low-pressure pumping units, one of 8,000,000- and one of 5,000,000-gal. per day capacity for supplying water to the coagulation basin. The pumps and connections are arranged in a manner which gives flexibility in operation, so that in case of accident to any pump or motor some other unit may be thrown into service to take its place.

All the structures above described have been built by the construction organization of Highland Park under the supervision of L. C. Whitsit, city engineer. Rate controllers and venturi meters were furnished by the Simplex Valve & Meter Co. and operating stands and gages by the Pittsburgh Filter & Engineering Co. The improvements were designed by Hoad & Decker, consulting engineers, Ann Arbor, Mich., who also acted in an advisory capacity during construction.

Definition of a Publicity Man

When newly elected officers of an engineering society gather around the table for the cabinet-making process the personnel of a publicity committee often is one of the hardest to name. Charles R. Thomas, in charge of publication of results, Forest Products Laboratory, Madison, gave the following definition to the delegates to the national engineering conference on public information held by the American Association of Engineers, Feb. 25. "It is almost impossible for one man to have a comprehensive knowledge of all the different work that has to be done, but wide experience in many lines of work and a broad sympathy probably constitute the best training for this work. A publicity man must have, in addition, keen judgment, a pleasing personality, a nose for news, the ability to write. He must know what people want and what they are interested in. It is work for a man of buoyant, well-poised temperament and a thorough education. He must have the poise of an editor, the vision of a promoter, the aggressiveness of an advertising man, the accuracy of a scientist engaged in research work, the suaveness of a diplomat, and he must be thoroughly imbued with the idea of developing the interests of other people rather than his own. He must be content to be a Boswell to many Johnsons."

Occupancy and Standardization of Buildings

Subjects Discussed at the Recent Annual Meeting of the Building Officials' Conference at Cleveland

BUILDING-LAW standardization, classification of building occupancy, and methods of construction, including tile, hollow brick walls and pressed steel joists, were discussed by the Building Officials' Conference at its seventh annual meeting last week at Cleveland. The conference declared by resolution that "every effort should be made to standardize the basic principles of building laws," and that the Department of Commerce be supported in its recently initiated attempt to carry out this work. In order to increase the value of the conference it was voted that special committees be appointed to investigate special subjects on which an expression of opinion might be desirable. Participation in joint committees with other societies was authorized, and extension of work on sectional committees of the American Engineering Standards Committee was approved. The conference is already represented in the sectional committee on elevator standardization.

The problem of securing an effective classification of building occupancies, for both regulatory and statistical purposes, was considered in a discussion opened by R. P. Miller, of New York. He mentioned the three classes used in New York—public, business and residence occupancy—and stated that these are too few, although it is necessary to hold down the number of classes to a minimum if effective administration is to be secured. Other members agreed with him in the opinion that a workable classification should be secured as soon as possible so that safe occupancy conditions may be maintained during city growth and attendant local changes. The principle was formulated that all occupancies in any one class should be interchangeable without issuance of a new certificate. W. C. Robinson, of the Underwriters' Laboratories, Chicago, asserted that occupancy determines the fire hazard, and that the classification must therefore be correlated primarily with fire protection. Classification for statistical purposes is being studied by the Chamber of Commerce of the United States, which has a group of twelve classes under consideration. Joint committee work with that body is planned by the officials of the conference.

A paper on "Building Zones," by R. H. Whitten, of the Cleveland city plan commission, made special mention of the importance of providing a board of appeals to handle special cases arising under a zoning ordinance. J. P. Healy, of Washington, and W. P. O'Rourke, of Newark, N. J., supported the author in this argument by experience with zoning in their cities.

Active discussion developed on the subject of projecting signs and marquises. M. S. Shinnick told of the extreme conditions existing in Kansas City and the efforts now being made by the city plan commission to have all street obstructions and projections prohibited. F. W. Lumis reported partial success in this direction in Springfield, Mass.; similar reports for Cincinnati and Newark, N. J., were made by G. R. Hansen and W. P. O'Rourke.

In a discussion of methods of building inspection G. S. Summerell and J. G. Houghton described the practice in Cleveland and Minneapolis of requiring the owner to employ a licensed inspector at his own cost. In

dealing with elevator inspection Mr. Summerell told of a recent census of elevators in Cleveland, when some 500 elevators were found for which no permit had ever been issued, but said that the situation is now in hand.

Papers were read by C. C. Crockatt on hollow tile and William Carver on thickness of brick walls for dwellings, the latter describing the "Ideal" wall construction, comprising inner and outer shells of brick set on edge, tied together by headers alternating with the stretchers. This construction was referred to a committee for investigation during the coming year.

Pressed-steel joists ("steel lumber") were discussed at a session at Massillon during an all-day visit to the plant of the National Pressed Steel Co. Buildings of three to ten stories in which such joists have been in service for periods up to 14 years were inspected, as was also the process of manufacturing the joists. The discussion centered on the inherent suitability of the construction for light-load service, and on the desirability of determining more definitely the degree of fire resisance obtained in relation to the fire resistance required for various occupancies. It was reported that action has been taken recently or is about to be taken by several large cities, among them Cincinnati, where steel lumber floor construction has not hitherto been used, to permit its use in schools, apartment houses and office buildings. The makers predicted that within a year or less the cost of the material might be reduced to equality with the cost of ordinary lumber as used in dwelling-house framing.

The meeting re-elected the retiring officers (R. P. Miller, New York, chairman; F. W. Lumis, Springfield, Mass., secretary-treasurer). The annual dues were increased from $5 to $10 for active members and $10 to $25 for subscribing members, to cover publication of the proceedings and circulation of a news letter at intervals during the year.

Publicity a Necessity to Stabilize Utilities as a Business

In an explanation of the predicament in which many water companies in Illinois find themselves by reason of the present agitation for abolition of the State Public Utility Commission, C. M. Roos, secretary, Cairo Water Co., holds that the entire situation is due to the attitude of aloofness which the utilities have taken toward the public. His views were given recently at a joint meeting of the Iowa and Illinois sections of the American Water-Works Association. Utilities have not talked to the people as freely as they should, and further he says that if the public really knew conditions as they exist today, there would be little difficulty. The utilities would be in a position to do financing to better advantage, confidence in their securities would not be shaken and extensions could be made, all of which would be of advantage to the consumer and tend toward the re-establishment of general business confidence. He suggested that the educational campaign should include the following points: (1) Visits by organizations to the works where instructors would explain details of operation, maintenance and costs; (2) investment by local people; (3) study of plant by school children, instructions being furnished by utility; (4) newspaper advertising and inclosure slips in local mail; (5) solicitation instead of discouragement of questions about service and complaints.

Ohio State Department Reorganized

AN ADMINISTRATIVE code for the State of Ohio effective immediately, creating the following eight administrative departments was enacted early in April by the State Legislature: (1) Finance; (2) Commerce; (3) Highways and Public Works; (4) Agriculture; (5) Health; (6) Industrial Relations; (7) Education; (8) Public Welfare. Each department is headed by a director. Each department director may, with the approval of the Governor, create unpaid and purely advisory boards to aid in the conduct of the work of his department.

Eight Departments Created

The directors of the eight departments, under the direction of the Governor, "shall devise a practical and working basis for co-operation and co-ordination of work and for the elimination of duplication and overlapping functions."

The salary of each of the eight department heads is fixed at $6,500 a year. The state architect and engineer will be paid $4,000 and the state highway engineer, $5,000, these two offices being the only ones established by the act under the Department of Highways and Public Works. The act provides that the superintendent of highways "shall be a competent civil engineer with at least five years' experience in the construction or maintenance of highways"; that the director of health "shall be a physician skilled in sanitary science"; and that the chief of the Division of Vital Statistics in the Department of Health "shall be a registered physician and a competent vital statistician." Heretofore the Bureau of Vital Statistics has been under the Secretary of State.

Except for department directors and division heads, other officials and employees in the eight new divisions are under civil service—many of them being transferred from the departments previously existing.

The old Public Health Council is continued in office, but no longer appoints the commissioner of health. The director of health, who succeeds the commissioner as a matter of title, is chairman of the Public Health Council and the latter body, like various other boards under the new régime, has advisory powers only.

Budget System Adopted

Among the duties of the Department of Finance one is to submit a budget to the Governor biennially and another is to "investigate duplication of work of the department and the efficiency of the organization and administration of department, and formulate plans for the further co-ordination of department." The Public Utilities Commission of Ohio, under the new code, becomes a part of the Department of Commerce for certain administrative purposes and the director of commerce becomes ex officio secretary of the commission, with the power to designate some employee of the department to serve as acting secretary and to "exercise the powers of the secretary of the commission."

The new Department of Highways and Public Works is given all the powers and is to perform all the duties previously vested in the superintendent of public works, the state highway commissioner, the chief highway engineer, and the State Building Commission. The Department of Education will perform all the duties previously vested in the office of the state geologist.

Controversy Over Use of Water of National Parks

Views Given of Western Engineer and Head of an Eastern Civic Association—Non-Partisan Commission Suggested

PROPAGANDA against the utilization of water in the national parks by storage mainly for irrigation purposes undoubtedly resulted in the favorable adoption by the last Congress of an amendment to the provision of the water-power act exempting the national parks from the jurisdiction of the Federal Water Power Commission. Following the publication of an editorial in *Engineering News-Record* Jan. 13, 1921, p. 49, in which a middle course was advocated between the radical nature-lovers and the ultra-utilitarians further inquiry has been instigated. Many letters have been received, typical of which are two below giving opposite viewpoints. They are presented because the fight, having been removed from the Water Power Commission, reverts to Congress.

J. Horace McFarland, the president of the American Civic Association, an organization responsible for much of the park-preserving propaganda in the general magazines, gives the whole subject consideration. Frank C. Emerson, state engineer of Wyoming, gives a Western engineer's viewpoint on a definite project with which there is large agreement by a representative of *Engineering News-Record*, who spent several weeks in 1919 in the Snake River Valley and also some time examining reservoir sites on the headwaters of the Snake in and out of Yellowstone Park.

The pertinent points in Mr. McFarland's letters, written in January, follow:

In *Engineering News-Record*, Jan. 13, p. 49, is an editorial headed "Parks and Water Power," in which you say in respect to the Esch bill removing the national parks from the provisions of the water-power act in Congress, that it "is supported by the usual hysterical nature-lover propaganda, which in its most rabid form—and in this form it has wide circulation—quite frankly would prefer a wilderness where two dozen men may hunt bear to a scenic reservior which supplies water, light and power to half a million people.

I do not think you wish knowingly to make any misstatements, wherefore I am providing you with the facts. The Federal Water Power Commission itself earnestly desires, on what Judge Payne calls "fundamental grounds of procedure," to be relieved of the continual pressure that will be made upon it if the Esch bill (H. R. 14,469) is not passed by those whom you describe as including "the ultra-utilitarian who would dry up Niagara or pipe the Yosemite." He insists that inasmuch as Congress has once set aside these parks Congress ought to determine on interferences with them. He is presumably a good lawyer, and he can hardly be called a "hysterical nature-lover." [This bill was passed.—EDITOR.]

Further on in the editorial another misconception is apparent. You say, "Much of the most necessary and valuable power in the country is within the limits of national parks." Inasmuch as the national parks as now constituted include in whole a total of but 1.11 per cent of the total public lands of the United States available to those who desire to develop water powers and irrigation projects it would seem that this statement was hardly based on the facts.

I am quite sure that if you had heard the evidence brought out incidentally at a hearing in connection with one of the irrigation projects that has desired to avail itself of what was proved by photographs and engineering data to be the most beautiful valley in the Yellowstone National Park, and affording within 20 miles of Old Faithful geyser a much needed automobile camping place for the thousands of tourists who use the Yellowstone National Park, you would have joined with the rest of us "hysterical nature-lovers."

I am equally confident that if you had heard at Des Moines, Iowa, a few days later, the statement of the agent of the promoters who are desirous of damming the Yellowstone River in the Yellowstone National Park, and had realized the engineering absurdity of the proposition, you would likewise have felt as we do with respect to that particular proposition.

I do not seem to know of any of the national parks which exists as "a wilderness where two dozen men may hunt bear." I do know that in 1920, according to the report of the director of the National Park Service, 1,158,445 visitors went into the national parks and monuments, this number excluding two parks, the one in Hawaii and the other in Alaska, and thirteen national monuments. It is on record that the use of the national parks *increased in 1920 117 per cent over 1917*. It is shown that in 1920 *128,074* motor cars, largely those of the farmers and business men within easy reach of the parks, used these wonderful recreation grounds, these museums of the great in scenery and the unique in nature's vagaries.

There exists an almost perfect example of "a scenic reservoir" which does *not* supply "power," light and water to a half million people, but does supply irrigation water to probably two or three thousand people, counting men, women, children and possibly domestic animals. Jackson Lake, south of the Yellowstone Park, has been made from what was admittedly one of the most beautiful lakes in the world into "a scenic reservoir." Inasmuch as the water impounded in it must be used when crops are growing it is drawn down during the summer. The result as shown by many photographs is the killing of all the flooded vegetation about the lake and the substitution for a lovely natural body of water of a slimy pond with a half-mile beach of mud and silt. This is the sort of "scenic reservoir" which seems to be somewhat in the mind of your writer, but which I think scarcely ever exists unless it has been built for that purpose and does not result from the flooding of gradually sloping land.

With the great respect I have for the engineering profession and for *Engineering News-Record* as its exponent, I cannot but regret the statement above referred to, which seems to miss both the facts and the spirit of the situation. Surely you would be willing to correct the obvious and direct misstatements made and to set the parks in the truthful light of the evidence submitted and masses of similar and indisputable evidence which can be provided.

In a later letter Mr. McFarland states that he is in favor of an inquiry by an impartial and non-partisan commission which would inquire into the water-power and irrigation possibilities of all the national parks, setting forth the information thus obtained in a report which would end the cross-fire of statement with respect to the necessity or non-necessity of using the parks at all for anything other than their stated purposes. Further he says:

I have not held and expect never to hold that anything in the nation belonging to the nation is sacred from actually needed use for the public benefit. If it is necessary to grow potatoes around the Washington Monument there ought to be no obection to thus providing food when that necessity is shown. If the whole nation, which owns the national parks, can advantage more by the use of the water in those parks for power production or for irrigation, or for both, than in the keeping of the parks as memorials of great scenery, as nature preserves the wild life of the land, as recreation grounds, then I would favor such necessitous use in the public interest. I should hope that *Engineering News-Record* would be willing to believe that for this bare 1 per cent of all the public lands private use should be avoided and public use promoted. Now if this is hysterical then I am rather glad to be so called.

The following statement of the issue in the matter of the proposed Yellowstone reservoir is made by Frank C. Emerson, state engineer of Wyoming, who is peculiarly qualified by his position to discuss it in an unbiased manner:

A vast deal of nonsense has appeared in the public print during the past few months in relation to what has been termed the "proposed exploitation" of our national parks, and particularly of the great Yellowstone Park in Wyoming. It seems that the questions involved, by plans to make a limited use of two certain reservoir sites within the limits of Yellowstone Park for the purpose of conserving waters to be used for irrigation purposes, are likely to go to judgment with only one side of the case heard.

As a result of applications for a permit to use Yellowstone Lake as a reservoir to store flood waters a special trip of inspection to the lake was made by myself in my capacity as state engineer for the purpose of obtaining first-hand information concerning the proposed development. From my observations on the ground, and a study of the situation generally, it was my definite conclusion that a limited use could be made of Yellowstone Lake as a reservoir, and, without any material detriment to the park, provide a great public benefit to the State of Montana.

The storage of water on Yellowstone Lake would be accomplished by the construction of a low masonry dam across Yellowstone River near the outlet of the lake. This dam could well be of artistic design, carrying a substantial roadway, and would undoubtedly present a feature of much interest to visitors in the park. According to the plan proposed water would be held in the lake at a point no higher than the present high-water level of the lake during the spring-flood period. The difference between normal low-water and high-water level in the lake, under conditions that now exist, is about 6 ft., the high-water level being reached during the quick run off of snow water in the months of May and June. The reservoir proposal is simply to hold in storage water at the high-water level for a period of about two months, allowing the normal discharge of the river to pass through at all times and controlling the water held in storage for gradual release during July and August. The beauty of the falls of the Yellowstone might well be enhanced if the proposed plans were adopted, as the water held back in the lake would be regulated and allowed to go over the falls in greater volume than is now possible during the low water period. As water would be held no higher at any time in the lake than is now in effect at the natural flood height during the spring floods it is evident that, despite the assertions of certain writers to the contrary, no vegetation in the park would be destroyed, no feeding grounds for animals would be disturbed, nor would any of the other natural wonders of the park be threatened.

The West recognizes our national park playgrounds as great assets and wishes to see them well protected. But there seems danger of extending the playground theory too far, and, by reason of fears unfounded in fact, interests that are vital to the West may be denied the privilege of making proper use of water which nature has provided. Montana has suffered greatly from drought conditions during the past few years. This was especially true in the year 1919. It is almost a tragedy when the farmer plants his crop in the spring, cares for it until the heat of summer and then must see it wither away for lack of proper irrigation during July and August. To thousands of Montana farms relief from such a condition can be brought by the storage of water at Yellowstone Lake. Good reservoir sites for the storage and conservation of our water supply are indeed rare. Yellowstone Lake would afford a wonderful reservoir, and it is doubtful if its equal can be found in the West. By reason of its immense area the storage of only 6 ft. of water over the lake would supply a necessary supplemental water supply for nearly 500,000 acres of land. Writers in no position to know the facts have asserted that necessary water should be stored without the park. From such information as I have been able to secure there are no feasible available sites without the confines of the park that will adequately serve the purpose.

The writer has not had an opportunity to visit the site of the proposed Fall River reservoir in the southwest corner of the park. From information at hand, received from competent judges, it is believed that this development could also take place without any material detriment.

The struggle of man to convert the arid wastes of the West into productive farm lands is a hard one at the best. The interests that have been referred to variously as "water grabbers," "despoilers of our parks," etc., are universally concerns or public organizations that have for their aim the creation of valuable farm lands where only desert wastes now exist. The projects generally promise little monetary return, but are rather undertaken as great public benefits. Anyone familiar with the history of irrigation development will recognize the truth of these statements.

If the people enjoying our national parks realized the true situation in regard to the plans that are proposed in connection with the storage of water in Yellowstone Park their verdict would undoubtedly be in favor of allowing development that, without injury to the wonders of our national playground, would bring great public benefits.

In the interest of fair play the projects that are proposed for development in Yellowstone Park should at least have a fair hearing and be decided upon the merits of each case to be considered. We can depend upon Congress to take such action as well as to guard properly the public interest, and the argument of the opening wedge can have but little consideration from people who know the facts and are willing to give the matter fair thought. To have wide pressure brought to bear upon Congress by the public through a sentiment created by clever writers, taking needless alarm at what they believe might work injury to our national playgrounds, is an injustice not only to the people of the West but to the entire nation.

A final comment on the situation is made, as follows, by the *Engineering News-Record* representative who visited this country in 1919:

(1) Every case should be considered on its merits by itself. (2) Mr. McFarland's suggestion of a non-partisan commission to get at the facts is good. (3) Few Eastern people realize the bigness of the park, with its vast stretches of uninteresting area and the welcome with which one greets a few man-made structures after hours of traversing jack-pine forest. (4) The value of automobile parking space in the wilds surrounding Old Faithful Inn are not to be confused with the parking problem in the loop district of Chicago. Robbing the deer of their grazing grounds has little point, for the real problem for the deer is winter, not summer, feed. (5) Doubtless there are stretches of wooded Yellowstone Lake shore that would be destroyed, but by a comparatively small expenditure this timber could be logged off. The shores visited were all comparatively steep, with shingle beaches. (6) Jackson Lake, seen at its lowest in history, produced even over the mud flats the prize picture of the summer's trip. (7) Since there is great agitation to include the Jackson Lake region in the Yellowstone Park why not effect a transfer, the park giving up the Fall River reservoir site for an equal amount of accessible and even more beautiful area in the Jackson Lake region? (8) Lastly, let us never forget that the irrigated land is so far in excess of the water available eventual utilization is as certain as existence. The Minidoka project of the U. S. Reclamation Service has actually created values in excess of $30,000,000 since 1904 and the water impounded in Jackson Lake played a most important part in the production of that added wealth of the country. Mr. McFarland's estimate of the benefit reaching to two or three thousand people only is therefore too ridiculous for answer.

Traffic Records Made at St. Marys Falls and Panama Canals

COMPARISONS of certain traffic records made at the Panama Canal and the St. Marys Falls Canal, Sault Ste. Marie, Mich., indicate in several instances that facilities on the ocean for handling bulk freight are not yet as efficient as those on the Great Lakes, according to information furnished by L. C. Sabin, general superintendent, St. Marys Falls Canal. Records of size and tonnage of ships and of coaling and discharging coal are cited, the figures from the Isthmus being taken from the *Panama Canal Record*.

The steamship "Friesland," with a cargo of 15,138 short tons of wheat passed through the Panama Canal Nov. 8, 1920, the largest cargo of wheat that had been carried through the canal. The "Friesland" is a vessel of 12,321 tons gross and 8,690 net tons, 520.7 ft. in length by 64.2 ft. beam, drawing 30.4 ft. in salt water at the time of transit. The steamer "W. Grant Morden," with a cargo of 15,149 short tons of wheat passed through the St. Marys Falls Canal, Oct. 9, 1919. The "Morden" has a tonnage register of 8,973 gross, 6,086 net tons, and is 625 ft. long with 59-ft. beam, and was drawing 20 ft. 10 in. in fresh water at time of passing.

The collier "Ulysses," discharged 12,030 tons of coal in 14 hr. 25 min., Nov. 12-13, 1920, which is equivalent to 834 tons per hour, allowing 1 hr. for clean up, etc. This was cited as a new record at the Cristobal coaling plant. On the Great Lakes this rate has often been exceeded. In 1918 the "G. G. Barnum" discharged 10,610 net tons of soft coal in 10 hr. 30 min., or at the rate of 1,010 net tons per hour. In 1919 the "Wm. A. McGonagle" made a record of 1,149 tons per hour.

On Nov. 25, 1920, the Cristobal coaling plant established a new record in delivering 1,102 tons of coal to the steamship "Wiltshire" in 1 hr. 35 min., or at the rate of 696 tons per hour, equivalent to 780 net tons per hour. This coaling record is often exceeded on the Great Lakes. In 1920 the "H. G. Dalton" loaded 13,880 net tons in 10 hr. 30 min., or at the rate of 1,322 net tons per hour, while in 1919 the "J. Pierpont Morgan" loaded 13,534 tons in 6 hr. 59 min., or at the rate of 1,933 tons per hour.

Motor Boulevard in Seattle

An ordinance providing for the opening of a new motor and street car street or boulevard is soon to be introduced into the council of the city of Seattle, Wash. This boulevard will extend south from a plaza in the vicinity of the railway station and will be 150 ft. wide. This width will have a middle section for street cars, two side roadways 20 to 24 ft. wide for motor travel, and a sidewalk on each side. At first it is intended to provide for only an occasional crossing which will be either overhead or under the boulevard with a fenced right-of-way and signs directing traffic to the crossing. As traffic increases additional crossovers or underways will be provided. The amount of motor travel now coming into the city of Seattle is so great that the city engineer, A. H. Dimock, who is recommending the scheme to the council, feels that it is necessary to provide some direct means of entering the city which will not add to the great congestion in the downtown district. While the boulevard may not be built immediately, the condemnation proceedings should start as soon as possible in order to get the advantage of the cheap land.

LETTERS TO THE EDITOR

If you have ideas that would interest engineers and contractors we shall be glad to give them space here. We urge, however, that you be brief so that a wide range of subjects may be covered in the available space.—The Editor.

Credit Due Dean Schneider

Sir—In my recent article on Antioch College I omitted to give credit to Dean Herman Schneider of the University of Cincinnati for the origin and development of co-operative college courses. It is generally known among American educators that the work of Dean Schneider at Cincinnati has brought so-called co-operative college education, that is, the plan of part time study and part time work, from the condition of a theory to a state where the experimental element has to a very considerable extent been eliminated and where others can follow him and take advantage of the very great contribution he has made in this field.

The co-operative plan is only one element in the Antioch College program, but it is an important element. The substantial success that Dean Schneider has attained has placed it and other similar undertakings under deep obligation to him.

ARTHUR E. MORGAN,
President, Antioch College.

Yellow Springs, Ohio, April 28.

Automatic Stream Discharge Recorders and the Parabolic Weir

Sir—The discussion of automatic recorders in *Engineering News-Record*, Dec. 9 and 30, pp. 1124 and 1297, and March 24, 1921, p. 521, has been very interesting, but I do not believe it is complete without mention of the parabolic weir, which is more readily adaptable to an automatic recorder, or meter, than any other form of notch.

The results of an investigation in the hydraulic laboratory of Purdue university on seven parabolic weirs were set forth in Paper 21-B, published by the American Society of Civil Engineers in January, 1921. The side of the notch in each instance was cut to fit the equation $x^2 = 2py$, the value of p ranging from 0.1 to 2.0 in. The results of these experiments may be summed up as follows:

(1) The parabolic weir is one of the best types developed and is adaptable to a wide range of conditoins. (2) The actual rate of discharge can be computed by the very simple formula $q = kh^2$, where q is the actual rate of discharge in sec.-ft.; k is a constant for any given weir with beveled edge; and h is the observed head in feet. (3) The value of k can be accurately predicted for any given value of p. (4) The parabolic weir is adaptable to a simple and accurate automatic recorder.

Triangular weirs have been used more extensively than other types in connection with automatic recorders, especially with feed water heaters. Meters for recording the flow through this type of notch are expensive and complicated in design. Furthermore, their accuracy is impaired at low heads because of the manner in which motion is communicated from the water surface in the channel of approach to the meter. Part of this investigation on parabolic weirs consisted in testing a recorder that was attached to the side of the channel up stream from the notch. This mechanism was actuated by a float attached to a slender shaft by a rod. Fastened to the other end of the shaft was a pointer that was caused to move outward from the center of a dial. The distance traveled by the pointer can be made proportional to that through which the float moves by a properly designed link. The squares of the distances moved by the float and by the pointer are directly proportional to each other. The tests also included a calibration of an automatic integrator that eliminated the use of a planimeter on the charts of the recorder. The recorder allows observations of the rate of flow while the total amount for any period of time can be observed directly on the inte-

grator. The tests showed the accuracy of the recorder to be 0.993 and that of the integrator, 0.996. The entire mechanism is simple in construction with but few parts, responds immediately to the slightest change in head and is accurate throughout the entire capacity of the weir.

Lafayette, Ind., April 9. F. W. GREVE,
Assistant Professor of Hydraulics, Purdue University.

Guessing at the Traffic Problem

Sir—Before me is the editorial "Guessing at the Traffic Problem," which appeared in your issue of April 7, p. 577. The proposal to which you refer was made seriously. However, I did not consider that all of the improvements which I discussed would be carried out within the next 200 years; something should be done every little while to alleviate the traffic congestion. May I call your attention to my notes on the paper in question, in which I advocate as follows the immediate construction of the expressway between Fifth and Sixth Aves.

"The expressway from 14th to 59th Sts., between Fifth and Sixth Aves., is of immedate importance and something which should be put through at once. Later, should motive power be developed doing away with noxious waste gases, this expressway should be projected under Central Park to the Bronx, thus giving to the city a most desirable traffic route.

"There is every reason why satisfactory results, from a financial standpoint as well as from utilitarian and aesthetic points of view, should be realized by the city in the creation of expressways. The great improvement at the Grand Central has given to the railroads a terminal the cost of which is carried by returns from the improvement."

Also, may I call your attention to the fact that Mr. Schaeffer, while figuring the cost, did not allow for profits to the city from the sales of property under excess condemnation, or for advance in ratables. Ample provision for the work could be obtained in this way.

In partial answer to the questions in the last paragraph of your editorial, I suggest that this whole problem be viewed from the standpoint, not of tempting traffic away from heavily congested routes, but of providing pleasant and attractive ways and means for traffic to be accommodated on just those routes most heavily congested. To my mind, congestion is not a condition to be eliminated. Alleviation, perhaps, if it results through accommodation, is good, but suppression is not.

New York City, April 22. CHARLES W. LEAVITT,
Civil and Landscape Engineer.

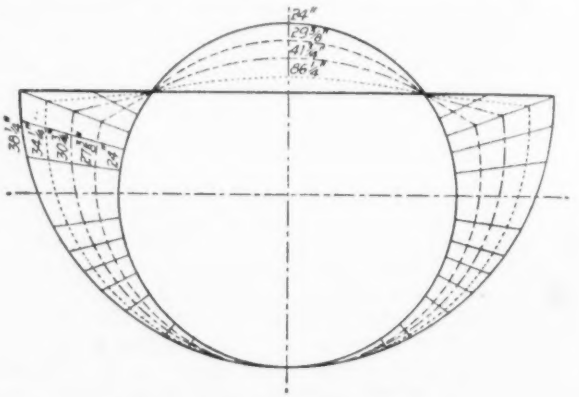
Accompanying the foregoing letter is a quotation from a communication to Mr. Leavitt from Col. W. J. Wilgus, consulting engineer and president of the New York Section, Am. Soc. C. E., which is reproduced below:

"If a double-track railroad is congested with a combination of through and local traffic there is not the slightest hesitation in increasing the number of tracks to four in order that the two kinds of traffis may be segregated. Why is not the same thing true with street traffic when the existing avenues have become so congested that vehicles in both local and express service, so to speak, are so inextricably mixed as to bring both to a standstill. In the case of the railroad there is no debate as to the necessity of increasing the number of tracks to meet the changed conditions. In the case of the street traffic, however, there seems to be a complete absence of fearlessness in meeting the situation boldly and solving the problem in a broad way.

"In the case of the Grand Central Terminal had we not shown temerity the public today would not be reaping the enormous benefits that have come from the tearing down of obsolete structures and the substitution of new ones. The same vision and courage must be shown in the case of the thoroughfares on Manhattan, and I for one believe that this should be immediately undertaken midway between Fifth and Sixth Aves., from Washington Square to the Bronx. I cannot avoid the conclusion that, properly done, this great improvement, through enhanced property values and reduced delays to the public, would be self-supporting, in addition to which the community as a whole would be permitted to expand. As in the instance of the vehicular tunnels, tolls might be charged for a sufficient period to amortize the cost."

A Graphical Solution of the Conduit Transition Problem

Sir—I submit herewith sketches and description of a method for developing intermediary sections in a transition for the benefit of some of the younger engineers, such as myself, who do not know the method suggested by Thomas H. Means in his contribution, "Inverted Siphon Terminates in Riser on Bridge Pier," *Engineering News-Record*, March 31, p. 562. I developed this method, which possibly is an old one, in connection with a similar problem several years ago. I am inclosing one of those old sketches [not reproduced—Editor] and a sketch showing the solution of T. H. Means' problem. I used a small scale in this latter problem and do not claim great accuracy for it. In the Jones Island, Milwankee, Wis., problem, the scale was



END VIEW OF PROJECTED CONDUIT

large enough to indicate ¼ in., which was accurate enough. I also wish to point out that owing to the peculiarity of Mr. Means' problem, his transition coming at a bend, my sections are not exactly his but they will give the same shaped transition if used at their proper relative positions, which are the ¼, ½ and ¾ distances between the two end sections. This point will be evident in the description which follows.

Project one end section of the transition upon the other end section, getting a vertical projection of the surface between them; select a convenient axis and draw radii to the limiting curves indicating the sections made by a plane revolving upon the given axis with the developed surface of the transitions. Then, if n number of sections are desired, divide the projected lengths of these sections into $n + 1$ parts and connect the loci, which will give the different sections.

A few practical points in connection with the building of the transition: Templets of stiff paper for one-half of a symmetrical section will be sufficient for making the bents. In assembling the latter keep them in their true relative positions and the lagging, preferably of narrow strips, in the directions of the radii in the sketch. It will be found convenient to start the lagging at the critical points and fill in between, using straight and wedge shaped pieces as necessary. Whenever one end shape intersects that of the other end the surface developed around these points will look like a corkscrew. I made twenty-five of these odd looking shapes in connection with the Jones Island project.

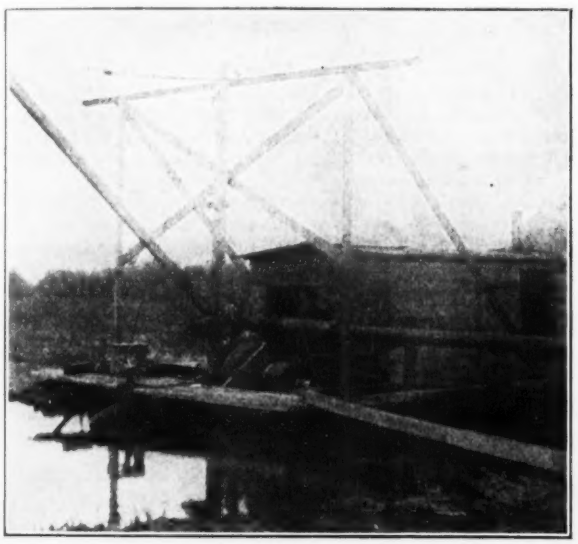
Steubenville, Ohio, April 11. ED. H. TASHJIAN,
Superintendent for Walker & Weeks, Architects, Cleveland, Ohio.

HINTS FOR THE CONTRACTOR

Submerged Gravel Pumped to Screens for Road Work

BY GEORGE E. JOHNSON
Engineer, Department of Public Works, Lincoln, Neb.

DURING 1920 the construction division of the Department of Public Works of Nebraska maintained two camps with pumping outfits, which were used for procuring gravel for road surfacing. One camp, located near Grand Island, is equipped with a pumping outfit consisting of a 6-in. gravel pump, belt connected to a 50-hp. gasoline engine, with a speed of 1,200 r.p.m., reducing the speed of the pump to 550 r.p.m. The engine was placed upon five pontoons, 5 x 18 x 3 ft.,



PONTOON-MOUNTED CENTRIFGUAL PUMP EXCAVATING RIVER BED GRAVEL

which were bolted together by timbers. A 1½-in. centrifugal pump discharges water continually into the shell of the gravel pump. In this way the solid material is kept in motion, and less trouble is had with pump clogging. This small pump was also used as a priming pump with which to start the larger pump.

Two men operate the plant. One man handles the suction pipe, lowering and raising it when necessary; the second man keeps the machinery in order and attends to the screen and bin. The dredge sucks the water and gravel from the lake bottom and carries it through a pipe 200 ft. in length to a 3 x 6-ft. No. 8 screen.

An average of 125 cu.yd. per day is delivered against a head of approximately 35 ft. By lowering the head 50 per cent, it was found that the production might be doubled. A 50-cu.yd. bin retains the gravel until it is dumped into trucks or trailers, the latter being pulled by a 120-hp. tractor. The finer sand, when separated from the gravel, is carried by a chute to a supply pile, where it is stored until sold for plastering sand.

The plant depreciation runs fairly high, as the pump will only pump approximately 50,000 cu.yd. of material. The original cost of the pump outfit is $4,000, and it is estimated that it will depreciate nearly 25 per cent per year, if used continually. The engine consumes approximately 40 gal. of gasoline a day, and 2 gal. of lubricating oil. Thus the costs of the operation may be given as follows:

Labor, 10 hours a day	$15
Gasoline, 40 gal. at 35c.	14
Lubricating oil, 2 gal. at $1	2
Depreciation based upon 200 working days, or per day	5
Total	$36

In 1921 it is expected to reduce these costs 20 per cent, due to the lower prices of labor and materials.

Bucket-Loader Converted Into Crane

USING a crane fashioned from a bucket-loader, nine bays of a factory building, having one apex truss and two lean-to trusses as indicated by the illustration, was erected in less than a week. The erection was done by workmen of the Mosley Construction Co., for the Barber-Greene Co., of Aurora, Ill.

Previous to the arrival of the structural iron workers, the owners rigged one of their self-feeding bucket loaders, in the fashion shown, as a stiff-leg crane. The bucket elevator was removed and a power winch installed on the frame which houses the gasoline engine.

FIELD-MADE TRAVELING CRANE ERECTING ROOF TRUSS

At one side of the motor frame an A-frame was attached with a platform at the opposite side weighted with sacks of sand to form a counter balance. This A-frame reached 32 ft. from the ground, high enough to erect the lean-to trusses. In order to use it on the apex trusses, the A-frame was extended by lashing to it a small telephone pole. This gave the boom a height of 50 ft. For additional safety at this height, ropes were strung from the boom to the steel work on each side. The original drive of the machine was not altered. Power was furnished by a 25-hp. gasoline engine. Six men comprised the crew.

NEWS OF THE WEEK

New York, May 5, 1921

Revised Belle Isle Bridge Plans Bring Lower Bids

Only Two Contractors Submit Prices for Complete Structure—Arundel Corp. Figure is $2,619,000

The two bids for the construction, according to recently revised plans, of the Belle Isle bridge at Detroit, submitted by contracting firms April 23, both exceed the amount remaining in the bridge fund. The Detroit Department of Public Works submitted a bid which was within the available funds and below the engineers' estimate. Only two complete bids were submitted by contractors, although a large number of notices of the proposed letting were sent out and about twenty firms requested copies of the revised plans.

The Great Lakes Dredge & Dock Co., Cleveland, O., submitted a bid of $2,943,541 for the complete work, as included in the last advertisement, or $2,920,261 for the work not including the waterproofing. There is approximately 194,000 sq.ft. of fabric waterproofing.

The bid of the Arundel Corp., Philadelphia, for the complete work was $2,618,922, or $2,599,522 with the waterproofing omitted, allowing $19,400 for the average cost of five types of waterproofing.

A bid for the structural steel work was submitted by the Whitehead & Kales Co., Detroit. The figures submitted were: For fabricating and erecting the structural steel, $144 per ton; for furnishing and erecting bronze bearings, 55c. per pound; metal roadway and sidewalk expansion joints, 6½c. per pound; metal hand railing and lamp posts, lump sum, $94,940.

The low bid is approximately $1,600,000 below the low bid received for the complete work when the proposed letting was advertised in December of last year. About $1,000,000 of this difference represents the decrease in quantities provided for by the revision of the original plans, and the remaining $600,000 represents the decline in unit costs.

Among the differences between the present design and the original design as submitted for bidding at the two prior lettings are: Reduction of the carrying ribs from nine to eight, the sidewalks now being cantilevered half their width beyond the outer rib; elimination of the pier extensions and the concrete lamp-standard bases supported on them; reduction of 17½ ft. in length of piers, reduction of pier bases and pile foundations, and rearrangement of the piling; revision of the pier footing design by the introduction of an unreinforced concrete seal course over the pile tops; simplification of spandrel details and pier shafts, and substitution of a single sway frame for two at each pier; substitution of plain earth embankments for retained approaches with stairways; omission of concrete dock construction at the north abutment; reduction in field riveting by allowing bolted bracing connections; and omission of the work of removing certain of the old bridge piers. These changes reduced the quantities sufficiently to reduce the cost, when computed at the minimum unit-prices of the prior bids, from $4,000,000 to $3,100,000.

While no definite action has yet been taken by the City Council, the contract will probably be awarded to the Arundel Corp. Steps are being taken to bring the company's bid within the amount available, which is approxmately $2,441,500, by omitting certain items such as paving, cinder concrete paving base and sidewalks, which can be supplied later.

The Department of Public Works bid was $2,389,957 and without waterproofing, $2,366,677. The department's bid was low on 16 of the 25 items bid on, but was high on the steel.

Am. Soc. C. E. Convention at Houston Approves Constitutional Amendments

With Minor Changes Committee Draft Stands—140 Present—President Webster Defines Municipal Engineering

The net result of the business session of the annual convention of the American Society of Civil Engineers at Houston, Tex., April 27 was a unanimous acceptance of the constitutional amendments presented by the committee on referred amendments. Automatically the amended instrument goes to letter ballot. The society's action was preceded by a three-hour discussion and futile attempts to make amendments, only one of which was of vital import. The discussion showed that influential adherents of both sides of former controversies were a unit in the determination not to tamper with the six month's work of the committee. This was all the more evident after a spirited address by Arthur P. Davis, punctuated by applause and one by Francis Lee Stuart, received with equal enthusiasm. George G. Anderson tested the temper of the convention shortly after the matter was open for discussion by a motion to amend the "objects," mainly by the addition of a clause on co-operation with other organizations. An extremely weak "aye" vote followed a lively discussion and thereafter none but minor changes were attempted and they failed. The committee brought in seven minor and explanatory changes, noted below, which were accepted without dissenting vote.

No other business was considered at the meeting, but announcement was made (1) of the decision of the publication committee to resume the publication of all paper and discussions in the *Proceedings;* (2) of the authorization of a committee to promote the technical interests and activities of the society, said committee to appoint sub-committees in each district to stimulate interest and activity along technical lines; (3) of the authorization of a research committee "to organize, stimulate and supervise the research work of the society, as conducted by its committees or through co-operation with other societies and individuals"; also a personnel of not more than 15 representatives, including the research committee, of the American Society of Civil Engineers on the advisory committee on civil engineering of the division of engineering of the National Research Council "whose duties it shall be to represent the society in its responsibilities therein as sponsor society in research work in civil engineering."

Constitution Discussed

The report of the committee on the Alfred Noble memorial indicated no progress, largely because of the failure to obtain designs within reasonable cost. Samuel Rea replaces Onward Bates as chairman although Mr. Bates remains on the committee. Robert Ridgway has been appointed secretary-treasurer of the committee.

J. H. Brillhart, chairman of the Texas Section, presided at the opening session when nearly 300 were present, although but 140 members and 72 guests had registered by evening. Governor P. M. Neff eulogized the engineer and his work and Mayor O. T. Holcomb welcomed the delegates to Houston. E. E. Sands, consulting engineer, described local and state engineering works. Mr. Webster followed with the annual address of the president on "The Municipal Engineer," whose wide province he defined largely from his own 40 years' experience in Philadelphia.

Under new business Peter Junkersfeld, chairman of the committee on referred amendments, read the brief report and the seven changes the committee desired to make to the amended constitution, as sent out to the members

March 19, and endorsed by local sections in Illinois, Louisiana, Spokane and San Francisco and a large number of individuals. Many changes had been suggested but the committee felt that it was inexpedient to act favorably on them. It recommended that all such changes be referred to the board or a special committee. Mr. Junkersfeld moved the adoption of the report and the discharge of the committee.

H. S. Crocker, acting secretary, read the communications of endorsement from the sections. Information was solicited as to the members present at the various meetings. It was learned that 10 attended the Louisiana meeting, 25 to 30 the Illinois section, 13 the one in Spokane, and 17 the session in San Francisco.

George G. Anderson offered the substitute amendment on "objects," as noted above, prefacing the introduction with the statement that he believed the spirit of all members was now progressive and that all were earnestly striving to build up the organization. Much discussion followed, with the members of the committee answering all questions, the main one being that the objects must conform to the articles of incorporation. L. L. Hidinger stated that this very point had been taken up with the society's attorneys, who advised the use only of the exact words in the charter which gave full authority for the cooperation demanded by Mr. Anderson.

Mr. Davis added that the attorneys had advised that the society could, if it desired, join the Federated American Engineering Societies and that the powers are not bounded by the constitution but by the articles of incorporation. The real question, he pointed out, was how to get rid of an antiquated constitution. He felt that it was impossible to make acceptable amendments by debate, for any such amendments would create suspicion and antagonism enough to prevent their passage.

Mr. Stuart found the amendments disappointing, but that they represented the judgment of eight men and he believed their work should be accepted, deferring further change to a later date. Mr. Anderson's motion was lost on a *viva voce* vote.

Prof. A. N. Talbot called attention to an obvious typographical error in the constitution, article VII, section 3 last line, the whole line of which was finally stricken out as of no import.

J. N. Chester then attempted to eliminate a sentence in section 1 of the same article allocating foreign members (560) outside of North America to District 1. He failed.

Gardner S. Williams made an equally unsuccessful attempt to eliminate a clause in section 9, same article, prohibiting listing or counting of votes. He desired to return to the present method of making the list available to members desiring it. Mr. Junkersfeld stated that the proposed secret method was that used satisfactorily by the other founder societies. At this point several members, including Mr. Sands of Houston and A. D. Butler of Spokane, spoke decisively against any further amendments. With Mr. Williams' motion lost overwhelmingly, the committee's report as a whole was adopted.

The seven changes proposed by the committee are as follows:

(1) In article VII section 1 of constitution relating to nominations make District 1 as at present include the territory within 50 miles of the New York post office.

(2) In article VII section 4, constitution, add a clause to the effect that no vote for a nominee for vice-president outside of a zone, or director outside of a district, in which the voter resides shall be counted.

(3), (4) In article X section 2 and 3, constitution, eliminate the word "several" before words "corporate member."

(5) In article V, bylaws, relating to student chapters substitute the regulations adopted by the Board of Direction Jan. 17.

(6) In article VI section 2, bylaws, relating to order of business omit the line "Appointment of members of nominating committee."

(7) Add a new transitory article VII to bylaws by which the ballot to be canvassed at the 1922 annual meeting shall contain the names of all persons nominated by the nominating committee in accordance with the existing constitution as well as nominations by declaration. In other respects the election is to be according to the amended constitution.

It was announced at Houston that Elbert M. Chandler, of Olympia, Wash., chief engineer, Washington State Reclamation service, had been appointed by the board of direction acting secretary of the society. An account of Mr. Chandler's professional experience appears elsewhere in these pages.

Minnesota Enacts Weak License Law

Any One May Practice as Engineer or Architect Provided Term "Registered" is Not Used

(*Special Correspondence*)

The bill providing for the registration of architects, engineers and land surveyors in Minnesota, has become law. It was modified by the Senate committee so as to make it the least effective, perhaps, of the numerous registration laws in the country. As prepared by the Minnesota joint engineering board, the bill followed very closely the model bill of Engineering Council. As passed, the act allows anyone to practice architecture, engineering or land surveying, provided that use is not made of the term "registered" in the title of those so practicing.

The new law specifically exempts from its provisions those employed by the state and political subdivisions thereof, instead of making registration by public employees compulsory. Provisions for reciprocity with other states and provinces of Canada are made. Partnerships and corporations are permitted to practice as if registered, as provided in Council's model bill. The architects and engineers of Minnesota had a hard task to secure the passage of any legislation affecting professions of architecture and engineering, and it is felt that it is now the duty of every architect and engineer to register, so that when the next legislature meets a solid front can be shown, and the amendment of the law secured.

Revised Townsend Road Bill Introduced

Provides for Federal Highway Commission, Federal Aid and $200,000,000 for 2-Year Program

Senator Townsend's revised road bill, in which the principle of federal aid is accepted, was introduced in the Senate April 29. It provides for the establishment, construction and maintenance of an "interstate highway system" and the creation of a "post roads and federal highway commission."

The highway commission is to be composed of five members who are to be selected with recognition of the geographical divisions of the country; each of the political parties is to be recognized. The commissioners are to be chosen by the President by and with the advice and consent of the Senate. Each commissioner is to receive a salary of $10,000. One of the commissioners selected is to continue in office five years, another four, another three, another two and the other for one year, but their successors are to be appointed for a five-year term. The commission is authorized to appoint and fix the salary of a chief engineer.

The commission is charged with the establishing of an interstate system of highways composed of primary interstate roads, which are to follow the most practicable routes. In the selection of the routes the agricultural, commercial, postal and military needs of the Nation are to be considered. The Federal Government may join with the state in improving connecting roads, but "no project shall be approved by the commission in any state until the state has made adequate provision for the maintenance of all highways selected by the commission in that state."

Basis of Approval

No project is to be approved until the state provides funds at least equal to the amount allotted by the Federal Government and until the state makes adequate provision for maintenance. On 100 days' notice the state is to put any road in a condition of proper maintenance or the work will be done by the commission and charged against federal funds allotted to the state.

The bill provides $200,000,000 for a two years program.

Only such durable types of surface and kinds of material are to be used as will adequately meet the existing or probable future traffic needs of the locality. The right-of-way is to be at least 26 feet wide and the wearing surface of the road is to be not less than 20 ft. wide, unless the commission should provide exceptions.

Federal funds are to be apportioned among the states as follows: One-third in the ratio which the area of each state bears to the total area of all the states; one-third in the ratio which the population of each state bears to the population of all the states; one-third in the ratio which the

mileage of rural delivery routes and star routes in each state bears to the total mileage of such routes in all the states. No state is to receive less than one-half of 1 per cent of one year's allotment. Any unexpended amounts at the end of the period during which they are to be available are to be reapportioned in the same way among all states.

The bill takes care of roads in public forests and in the public-land states. In states containing unapportioned public lands exceeding five percent of the total area of the state the share of the United States is not to exceed fifty per cent of the cost of the road plus a percentage which the area of unappropriated public lands bears to the total area of the State. The bill provides an appropriation of $15,000,000 for forest roads in 1922 and $10,000,000 in 1923. Roads in Indian reservations also are cared for.

Embodied in the bill is a provision authorizing the Secretary of War to transfer surplus material suitable for road building purposes to the Commission for distribution to the everal States.

Engineers Report on Sewage Disposal for Los Angeles

An increase from $12,850,000 to $14,000,000 in the proposed bond issue for trunk sewers and sewage disposal at Los Angeles, Cal., has been recommended by the recently appointed special sewage disposal commission, consisting of George W. Fuller, consulting engineer, New York City; Prof. George C. Whipple, Harvard University, Cambridge, Mass.; and William Mulholland of Los Angeles. The general scheme (see *Engineering News-Record*, Feb. 24, p. 331) for a new outfall sewer and various trunk branches and for fine screening before the discharge of the sewage into the Pacific Ocean is, in effect, endorsed, but in addition it is recommended that in place of a single outlet into the ocean deep multiple outlets be provided in order to get better dispersion, that the outfall sewer be so built "as to resist disintegration from sewer gases, so far as this is practicable," and that an activated-sludge plant having a capacity of at least 2,500,000 m.g.d. be built in order to test the possibilities of recovering fertilizer values from the sewage and of providing an effluent that might be used for irrigation.

The report makes clear, however, that the sewage could not be used for irrigation during a considerable part of the year when there is surplus water from the Los Angeles aqueduct for irrigation. The report also makes clear that there is some doubt as to whether the activated-sludge process would yield any net return on sludge dried and prepared for sale as fertilizer. The capacity proposed for the ocean outfall is "at least 210,000,000 m.g.d." The commission will meet in New York, probably some time late in May, to elaborate and complete its report.

Am. Soc. C. E. Appoints Chandler as New Acting Secretary

Elbert M. Chandler, chief engineer of the State Reclamation Service, Olympia, Wash., was elected acting secretary of the American Society of Civil Engineers at the annual convention at Houston, Tex., April 27, by a vote of 13 to 5 in the board of direction. A permanent secretary requires a vote in the board of at least 18 out of the 30 members. Mr. Chandler will take office May 11 and will hold office until the January meeting.

Mr. Chandler was born in Santa Cruz, Cal., in 1886. His professional work started in 1906 when he was hydrographer and engineer assistant on hydraulic reconnaissance of the Oregon Railway & Navigation Co. From that time to the present he has been actively engaged in irrigation work in the west, being connected with the San Joaquin irrigation project, the Tuolumne Water Power Co., the Pasco Power & Water Co., the Burbank Power & Water Co., and the Naches-Selah Irrigation District in Washington. He resigned as chief engineer of that district in 1919 to become the first chief engineer of the Washington State Reclamation Service. Mr. Chandler was granted the degree of B. S. in civil engineering by the University of California in 1912.

A. A. E. Convention Plans Announced

The seventh annual convention of the American Association of Engineers will be held at the Hotel LaFayette, Buffalo, New York, May 9, 10 and 11. The program for the first day includes the appointment of special committees, reports of officers and standing committees, and the report of judges of the election of officers. A discussion of chapter activities in practice by F. H. Newell, director of field forces of the association, will be followed by committee and council reports on employment, railroads, industries, federal, building and insurance trustees, salaries of engineers in public service and teaching service, education, services and fees of practicing engineers, legislative, chapter activities, municipal problems, water power and conservation, relation to foreign engineers, balloting, and organization. A smoker and entertainment will be held in the evening.

On May 10 the report of the committee on revision of the constitution and by-laws will be received and discussed. In the afternoon a trip to Niagara Falls will be made.

The discussion and voting on amendments to the constitution and by-laws on the morning of May 11, will be followed by a preferential voting to determine the next convention city, and a report of the resolutions committee, and the convention will adjourn. In the evening will be held the annual dinner and installation of officers.

Lockwood Committee Takes Up Water-Meters

Intimation that Exclusion of Badger Meter was Due to Efforts of Competitors, not Substantiated

The Lockwood Committee which, after several months' recess, has resumed investigation of the building situation at New York City, touched last week upon the refusal of the New York Board of Aldermen to permit the use in the city of water-meters manufactured by the Badger Meter Manufacturing Co., of Milwaukee. The counsel of the committee, Samuel Untermyer, tried to make it appear that the action of the aldermen was due to a desire to keep out of New York City the meters of those manufacturers who are not members of the Meter Manufacturers' Exchange. No evidence, however, was introduced to show that members of the exchange had actually brought influence to bear upon the board of aldermen; inferences that there was such influence were drawn merely from the board's refusal of permission.

While it was stated that only the meters manufactured by the members of the exchange could be used in New York City it is a fact that the meters of one non-member of the exchange, the National Meter Co., may be used. The Badger meter has been approvad by the chief engineer and by the commissioner of the Department of Water Supply, Gas and Electricity. A bill passed by the New York Legislature at this year's session, which would have made the approval of the chief engineer final and would have taken authority to approve from the board of aldermen was vetoed by Mayor Hylan. The insinuation was plain at the hearing that this was a further step in the procedure to keep the Badger meters out of the city.

As usual in the Lockwood hearings, no rebuttal testimony was offered.

Since the hearing, the witness who gave most of the details regarding the exclusion of the Badger meter has stated that he had been approached for a bribe, the solicitor of the bribe saying that unless it were paid favorable action could not be expected from the board of aldermen.

Activities of Exchange

The members of the Meter Manufacturers' Exchange are: The Worthington Pump and Machinery Co., Harrison, N. J.; Union Meter Co., Worcester, Mass.; Neptune Meter Co., New York City; Thomson Meter Co., New York City; Pittsburgh Meter Co., Pittsburgh, Pa.; the Hersey Co., South Boston, Mass.; American Meter Co., Buffalo, N. Y. The Badger, the National and the Gamon companies are not members of the exchange.

The exchange was established in 1916 and, in addition to the interchange of information regarding prices at which meters are sold, has standardized meter

couplings and nomenclature and has adopted a business policy aiming to put the selling of meters on a business-like basis. This policy includes standards relating to guarantees. The most important activity of the exchange, however, has been its effort to work out standard specifications and guarantees for water meters, the purpose being to do away with the costly results due to special designs required to meet the odd specifications and guarantees constantly being written by municipal engineers. As a result of its efforts a joint committee on a standard meter specification was appointed by the American and the New England water works associations.

Information on prices, along the usual lines of open-price associations, has been exchanged, but only after the business has been closed. Information on bids has been exchanged only after the bids have been opened. The Federal Trade Commission has been apprised of the activities of the exchange and the books and minutes have constantly been available to members of the commission.

Waddell Named on Commission for $10,000,000 Bridge in China

Dr. J. A. L. Waddell, consulting bridge engineer, of New York City, has been appointed by the Chinese Government as the American member of an international commission to examine and report upon the bids submitted for the new bridge which the Peking-Hankow Railway expects to build over the Yellow River. The commission will be composed of four engineers — one American, one British, one French, and one Belgian.

The new Yellow River bridge will be about 9,000 ft. long, and will be located about half a mile from the site of the present structure. The bed of the river consists of soft silts and mixed sands and clays to a depth of at least 150 ft. or more, as borings have not been carried any deeper. The river channel at low water is comparatively small, but is likely to occupy any portion of the 9,000 ft.; at high water the river frequently spreads out to the full width of 9,000 ft., and may scour quickly to a considerable depth at any point and silt up again as rapidly.

The old bridge consists of short spans of about 70 and 100 ft. length, carried on screw piles. Owing to the extreme softness of the materials the old bridge has never been very stable. It has been stated that at some points the bridge settles several inches as each train passes over, recovering after the load has been relieved. The new structure is required to have massive masonry piers carried to such a depth as to insure a solid substantial foundation.

It is expected that there will be one or more bids from each of the four countries represented on the commission. The cost of the structure is likely to be in excess of $10,000,000. Bids will be received in Peking on June 30.

Dr. Waddell will sail shortly, and the commission will assemble in Peking the latter part of June. The Chinese Government will consult with him concerning several other large railway and bridge projects which they are contemplating.

Passaic Valley Sewage May Enter New York Bay, Court Rules

The United States Supreme Court on May 2 refused to enjoin the Passaic Valley Sewerage District from discharging the screened and settled sewage of Paterson, Passaic, Newark and other communities into upper New York Bay through a multiple outlet at Robins Reef, not far from the Statue of Liberty. The suit was brought many years ago by the State and City of New York to prevent alleged dangerous pollution.

The court holds that the evidence fails to show that a public nuisance would result or that there would be a serious addition to the existing pollution of the harbor, even if the sewage were not treated to a degree beyond the stipulations under which the Federal government withdrew its suit against the Passaic Valley District. The court points out that the district is required, by the stipulations, to carry the treatment of the sewage further than the present plans provide, if the Federal government so demands. The court also states that the whole problem of harbor pollution is one for co-operative study and action rather than litigation. The suit is dismissed without prejudice to the renewal of an application for an injunction if the New York authorities think such action warranted after the sewage-works and outfall are put in operation.

Injunction Refused—Port of New York Pact Signed

On April 29 New York State Supreme Court Justice Francis B. Delehanty refused to continue a temporary injunction obtained by the City of New York to restrain New York commissioners from signing the Port of New York Treaty with commissioners from New Jersey. The treaty was signed on the following day. In the meantime the Port Authority had organized informally with Eugenius H. Outerbridge, of New York, as chairman and J. Spencer Smith, of New Jersey, as vice-chairman. B. F. Gresson, Jr., previously chief engineer New York, New Jersey Port and Harbor Development Commission, was appointed chief engineer.

With the Port Authority formally organized application can be made to Congress to sanction the functioning of the body. Public hearings will be held preliminary to formulating a "comprehensive plan" for the port that must be submitted to the legislatures of the two states before Jan. 1, 1922.

Public Works Department Coming, Says Hays

Discussing probable plans of the Administration at Washington, in a speech delivered last week before the annual convention of the American Newspaper Publishers Association, Postmaster General Will H. Hays, former chairman of the Republican National Committee, indicated that among the changes to be expected would be the substitution of the name "Department of Public Works" for the present Department of the Interior and the transfer of all non-military work from the War and Navy Departments to civilian departments of the government.

ENGINEERING SOCIETIES

Calendar

Annual Meetings

AMERICAN ASSOCIATION OF ENGINEERS, Chicago; Seventh Convention, Buffalo, N. Y., May 9, 10 and 11.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS, New York; Spring meeting, Chicago, May 23-26.

AMERICAN WATER WORKS ASSOCIATION, New York; Convention, Cleveland, June 6-10.

NATIONAL FIRE PROTECTION ASSOCIATION, 87 Milk St., Boston. Annual meeting, San Francisco, June 14-15-16.

AMERICAN SOCIETY FOR TESTING MATERIALS, Philadelphia; Annual meeting, Asbury Park, N. J., June 20-24.

The Western Society of Engineers' coming election will provide members an opportunity to exercise a choice between two tickets. In addition to the nominating committee's selections, as given in this journal April 14, p. 658, the following ticket by petition has been filed: President, W. W. DeBerard; first vice-president, Fred J. Postel; treasurer, Robert I. Randolph; trustee, A. W. Dilling.

The Corporation of Professional Engineers of Quebec, at a meeting held recently in Montreal, elected the following officers: President, A. R. Decary; vice-president, K. B. Thornton; secretary, Frederick B. Brown.

The Engineers' Society of Western Pennsylvania, civil section, at its bi-monthly meeting, May 3, at Pittsburgh, Pa., will be addressed by F. W. Mohlman, chief chemist, the Sanitary District of Chicago, Ill., on "The Miles Acid Process of Sewage Treatment."

The National Highway Traffic Association, at its annual meeting to be held at the Automobile Club of America in New York City, May 13, will be addressed by J. E. Pennybacker, secretary, the Asphalt Associa-

lected and presented to the whole commercial community, buyer, seller and banker, by some department of the government which approaches the problem in a purely objective way, which will hold the individual's return absolutely confidential; and from which the whole public and the industry can enjoy equality of service. Such services are partially conducted in many different bureaus of the government, but to accomplish their real purpose and greatest value they must be consolidated and conducted more efficiently and from a much broader point of view. I have little doubt that the present expenditures of the government, if directed by consolidated effort, would cover the entire service necessary.

As to the situation in the building trades, Mr. Hoover said that public confidence had been destroyed to a great degree through recent investigations—doubtless referring to the New York situation—in which there had been given daily evidence that "combinations and conspiracies existed to maintain fictitious levels, a condition resulting in extortionate waste and profit, and corruption of various kinds."

Mr. Hoover asserted that reduction in railroad rates must come ultimately if the economic levels of the country are to find equilibrium. It was his contention also that there must be a commodity and class readjustment in rates inasmuch as "horizontal rate increases have thrown the relativity of rate scales out of gear, both as to value of commodities and sources of distribution." He questioned the advisability of a continued use of an emergency horizontal basis of rate increases. Though this rate-making method was based fundamentally upon charges varying roughly with commodity values, it had been "modified by competition and by the deliberate policy of railroads to stimulate local industries and local production."

Freight Rates on Road Materials Lowered in Michigan

The Public Utilities Commission of Michigan has ordered reduced 25 per cent for the lower peninsula and 22 per cent for the upper peninsula the freight rates upon the intrastate movement of sand, gravel and crushed stone. The decision applies to road hauls and switching rates and becomes effective May 10. The order of the commission is a result of a fight for reduction started by the various road commissioners of the state early last winter. In the opinion of the commission the reduction was required to insure a large movement of construction materials particularly needed in road work.

Northwest Lumber Production

The West Coast Lumbermen's Association announces that for the week ended April 23 lumber production of 115 mills reporting to it amounted to 56,311,309 ft. b.m., 33 per cent under normal. New business totaled 71,943,159 ft. b.m., and local business, handled by team and auto trucks, 5,014,498 ft. b.m.

Construction Articles in This Issue

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Shield vs. Trench Method for Hudson Vehicle Tubes Page 764.

Good Practice and Some Features in Log-Flume Construction Page 768.

Submerged Gravel Pumped to Screens for Road Work Page 779.

Bucket Loader Converted Into Erection Crane Page 779.

Highway Bid in Arizona 65 Per Cent of Estimate

In a recent highway letting in Arizona eleven contractors bid upon a piece of work for which the estimate was, excluding cost of material furnished by the state and 10 per cent for engineering and contingencies, $100,601. The lowest bidder submitted a bid of $65,076 and the highest a bid of $91,987. The contract as awarded was composed of three sections, each contractor who bid bidding on the three sections. There were twenty-nine items included in the work, the largest of which were excavation, borrow, dry rubble retaining wall and Class B concrete for slab culverts. The respective estimates and low bids, expressed in unit prices, for these four items were, in order, as follows: Excavation, $1.90, $1.48; borrow, $1.90, 45c.; dry rubble retaining wall, $5, $2.50; Class B concrete for slab culverts, $27.20, $18. This was for only one section of the three, and made a total difference between estimate and bid of $20,000.

On a bridge contract which was let about the middle of April by the Arizona Highway Department thirteen contractors bid, the estimate of the work being $33,404, excluding cost of materials, engineering and contingencies, and the low bid $21,581.

Tax Exemption Stimulates Building in New York

During the past eight weeks apartment-house building in the five boroughs of New York City shows a 454 per cent increase over the corresponding period of last year for the same type of construction. The impetus is attributed largely to the tax exemption ordinance recently passed by the Board of Aldermen. The records show that during this period plans filed call for the accommodation of 2,733 families compared with apartments for 493 families planned a year ago. The average cost of the new apartment is $4,689 and they are all designed to fall within the $5,000 limit of the tax exemption ordinance. For all types of homes plans have been filed for the accommodation of 6,746 families as against 3,689 families for the same period a year ago, an increase of 83 per cent.

Contracts Let for April Exceed $105,000,000

The total value of contracts let during April as reported in *Engineering News-Record* was $105,667,398. This represents approximately 46 per cent of the total value of contracts let during the corresponding period of last year. However, omitting industrial construction from the two figures, the April, 1921, figure is $94,320,812 and $160,132,138 is the figure for April, 1920.

In only two classes of construction did the contracts let for April, 1921, exceed those of 1920. These two were water-works and excavation and dredging, the figures being: Water-works, 1920, $2,849,951; 1921, $3,342,150; excavation and dredging, 1920, $446,787; 1921, $580,039.

The two classes of construction in which there is shown at the present time the greatest activity compare well with last year's figures, the total value of street and road contracts during April of this year being 77 per cent of those let during April of 1920. The respective figures approximate $40,000,000 and $31,000,000. In miscellaneous building the total value of contracts let during April 1920 was approximately $90,000,000, and the total for April of this year is in excess of $51,000,000.

These figures do not take into account the decrease in the cost of construction of this year over last, a figure which is generally accepted as ranging between 10 and 15 per cent.

$230,000,000 Railroad Bond Issue Quickly Taken Up

Following the authority issued by the Interstate Commerce Commission, April 25 for the issue of $230,000,000 joint fifteen-year convertible gold bonds of the Northern Pacific and Great Northern Railway Cos., the subscription books of the bankers syndicate were opened April 28 and closed April 30. The authority of the commission provided that bonds should be offered made less than 91½ but the offering was at no at 96½ and interest, to yield about 6½ per cent. On April 29 it was announced by the bankers syndicate, headed by J. P. Morgan & Co. and the first National Bank of New York City, that the subscription books would close on the following day. The transaction is said to be the largest single private financing project that has been floated since the war.

Lockwood Committee Resumes Its Investigation

After a recess of four months the Lockwood joint legislative committee on housing has resumed its investigation of building conditions in New York City. It is centering its attention, with Samuel Untermeyer continuing as counsel, on the operations of various financial institutions concerned in home building.

Business Side of Construction

Facts and Events that Affect Cost and Volume

Base-Plus Price Involved in Case Against Steel Corporation

Upon the application of the Western Association of Rolled Steel Consumers and other users of steel products, a complaint was issued April 30 by the Federal Trade Commission against the United States Steel Corporation and eleven subsidiary companies. Issuance of the complaint means that a majority of the commission has reason to believe that the respondents are using an unfair method in competition in violation of Section 5 of the commission's organic act and Section 2 of the Clayton Act, the specific charges involving the use of a device known as the "Pittsburgh plus" price, wherein all steel except rails, wherever made, and whether made by U. S. Steel Corporation plants or by independents, is sold at the f.o.b. Pittsburgh price plus an amount equivalent to the freight to destination.

The case is an outgrowth of conditions complained of by more than 2,700 fabricators of steel in the Chicago, Duluth, and Birmingham districts by legislatures of three states, by several municipalities, and by chambers of commerce and many business organizations throughout the United States, according to the Federal Trade Commission's statement. Through the operation of the "Pittsburgh plus" price, purchasers outside of Pittsburgh must pay for all rolled steel except rails a price arbitrarily fixed by adding to the Pittsburgh base price the freight rate on such steel from Pittsburgh even though the said product is not purchased at or shipped from Pittsburgh. For instance, the complaint cites that with the Pittsburgh base price on rolled steel in Pittsburgh at $50, the Pittsburgh plus price at Duluth, Minn., for rolled steel manufactured in Duluth and delivered to the purchaser in Duluth is $63.20, the added $13.20 being the imaginary freight charge from Pittsburgh to Duluth though the steel in such cases is not shipped from Pittsburgh, but is manufactured and delivered in Duluth.

The complaint further charges that the system complained of "enables Pittsburgh steel manufacturers to secure substantially 50 per cent of the steel manufacturing business of the United States," and that it "retards the natural steel-manufacturing growth of other sections of the country"; that it also "enables the steel manufacturers to maintain substantially uniform prices" as well as "sufficiently high prices for their product to operate at a profit without having their business jeopardized by the lower cost of steel manufactured in other sections."

The respondents are given 30 days within which to make formal answer to the complaint.

Report of Housing Given by U. S. Chamber

In a report recently made public and prepared by the civic development department of the Chamber of Commerce of the United States, the conclusion is reached that "until cost of house construction raches a basic level, it is not believed that there will be an adequate amount of building." The report indicates that one of the big problems to be solved in housing is how to raise the necessary capital. After studying fifty-seven housing and financing companies, the civic development department found that forty-six secured their capital from local subscriptions from individuals, four in part from banks, insurance companies, etc., and one from the parent company. Second only to the high cost of building as a deterrent to investment in new housing is the general belief that houses erected since the war are not as well constructed as older houses, continues the report. The report recommends the giving of prizes for best buildings and adherence to professional codes of ethics and building and housing codes to improve the character of building construction. The report lays special emphasis upon the high cost of building and efforts made aiming at a reduction thereof.

What Business Is Doing To Reduce Cost

American business men are cutting down their overhead expenses to meet the public demand for lower prices, by (1) calling for more work from fewer men, (2) demanding greater efficiency per inch of advertising, (3) depending more on budget and accounting systems and (4) scrutinizing credits more closely, according to a recent survey made by the department of domestic distribution of the Chamber of Commerce of the United States. Answers were received from some 2,000 business men, retailers, wholesalers and manufacturers and the questions asked had to do only with distribution costs. Answers which dealt solely with production problems were omitted.

The greatest variety of answers was received in response to the question: "What are you doing to reduce your personnel cost to a normal basis?" The general tone of these answers was not so much toward a reduction in wages as in number of personnel. Then, increased efficiency came with the cutting out of the deadwood. Only about one-fourth of those who answered had made any direct reduction of wages, though approximately 58 per cent had reduced the number of employees. One-fifth reported elimination or reduction of commissions and bonuses.

Hoover Discusses Vital Public Issues

Recommends Governmental Statistical Service—Reviews Building and Railroad Situations

In his address before the annual meeting of the Chamber of Commerce of the United States at Atlantic City last week, Herbert Hoover, Secretary of Commerce, proposed the establishment of a federal statistical service as an antidote to wide and rapid fluctuation of commodity prices; reviewed conditions in the building industry; analyzed the railroad situation, asserting that railway rates must be readjusted and reduced; and asserted that the condition of the export trade of the United States warned every American that "we have no isolation from the problems of the world." In discussing the commercial situation Mr. Hoover said that "it would be foolish not to acknowledge frankly we are in the midst of great economic difficulties, but it is infinitely more foolish for any one to think that we will not grow out of this situation."

In speaking of the service a Federal statistical bureau might perform Mr. Hoover said:

"Viewing the disastrous phenomena of boom and slump in the light of what the government can properly do, I believe there has been a great underestimation as to the potential importance to commerce and industry in this connection of an adequate service of statistics. I believe that the stability and soundness of business can be greatly enhanced and that vicious speculation can be curtailed by a more adequate information service maintained by the government.

What I mean is that we should have more timely, more regular and more complete information of the current production and consumption and stocks of every great commodity in the United States. I am convinced that we should go even further than this; that we should secure and publish the proportion of the total equipment of more important industries that is in current production, together with the total proportion of labor complement that is in service; and that in a few commodities it may be well to procure and publish the primary prices.

If, for instance, last autumn the public had realized that our stocks of coal on the surface were probably above normal, that at the time they were bidding for coal at $15 per ton the actual realization at the mine was probably less than $4; if they had been aware that the capacity of the coal mines was even then not running over 80 per cent.; that the limitation of supply was due to railway difficulties which would be solved with a little patience, then I am convinced that many sensible people would have stayed out of the coal market, and that we should have had no buying panic, with its profiteering, its consequent slump and great losses.

Another instance is the rubber industry, and I believe the members of that industry will bear me out in saying that if there had been an accurate monthly statement of the current ratio of production capacity and operation in the different branches of the industry, and of the stocks of major manufactured and raw materials in hand, they would have been saved tremendous losses not only in over-accumulation of goods, but also in over-expansion of equipment.

Various industries have tried time and again to secure such data informally, but it is essential to success that it should be col-

tion, on "Relation of Methods of Financing Highway Improvements to Present and Future Traffic" and by Arthur H. Blanchard, professor of highway engineering, University of Michigan, on "Highway Improvements Should be Based on Transportation Surveys." The reports of the following committees will be presented: Sign Posting for Detours, chairman, Elmer Thompson; Overloading of Motor Trucks, chairman, David C. Fenner; Regulations Covering Speeds, Weights and Dimensions of Motor Trucks and Trailers, chairman, George H. Pride. There will be an informal dinner at 7 p.m.

PERSONAL NOTES

DEAN A. E. BURTON of Massachusetts Institute of Technology has resigned effective at the end of the present school year. Dean Burton is a graduate of Bowdoin College, S.B. 1878; C.E. 1881. He has been connected with the Massachusetts Institute of Technology since 1882 when he became instructor in civil engineering. In 1884 he became professor of topographical engineering, and when the office of dean was created in 1902, he was appointed to the position. In 1896 he was in charge of a scientific expedition to Umanak, North Greenland, having for its object the establishment of new magnetic and pendulum stations.

W. L. MACKENZIE, formerly of the engineering staff of the Riordan Co., Ltd., Kipawa, is now with the engineering staff of the Welland Ship Canal at St. Catharines, Ont.

E. H. BARKMAN, for several years located at Sacramento, Cal., as Western representative for the Missouri Valley Bridge & Iron Co., has been transferred to Little Rock, Ark., in charge of the substructure of two bridges to be constructed by the company.

GEORGE COUTTS, formerly good roads engineer at Bertile, Man., has been appointed assistant engineer, Trent Canal, Department of Railways and Canals, Peterboro, Ont.

CLARENCE M. BROOKS has resigned as division engineer of the New Hampshire State Highway Department to become highway commissioner of Vermont.

I. VERSCHELDEN has been appointed master of bridges and buildings, Farnham division, Quebec district, Canadian Pacific Ry. Co.

FIELDER & BURLINGAME is a firm of engineers recently organized by Frank M. Burlingame and Richard L. Fielder with offices in Buffalo, N. Y., to specialize in making reports and appraisals.

W. E. MOSS has been appointed city engineer of Mt. Vernon, Wash.

DAVID H. FLEMING, formerly town engineer, Owen Sound, Ont., has been appointed city engineer of Niagara Falls, Ont.

A. L. GRANDY, assistant general manager of the Pere Marquette Ry., located at Detroit, Mich., has been appointed chief engineer.

JOHN A. BAIRD, formerly city engineer of Sarnia, Ont., has entered private engineering practice as consulting engineer and Ontario land surveyor, specializing in surveys, drainage, sewerage, water works and pavements.

CRECELIUS & PHILLIPS, a firm of consulting, constructing and operating engineers, has been organized by Lawrence P. Crecelius and Victor B Phillips, with offices in Cleveland, Ohio.

H. P. SHOEMAKER, for eleven years city engineer of Lock Haven, Pa., has resigned to enter private engineering practice.

BRUCE ALDRICH has resigned as district engineer of the Asphalt Association in charge of the Canadian district offices, Toronto, Ont., to become associated with Kilmer M. Barber, Ltd., Toronto, Ont. He was formerly chief inspector of asphalt with the municipal laboratory at Baltimore, Md.

MERTON R. SUMNER, until recently chief industrial engineer of the Fuller Industrial Engineering Corp., a subsidiary of the George A. Fuller Co., New York City, is now chief engineer with Arthur D. Little, Inc., Chemists, engineers and managers, Cambridge, Mass.

HENRY C. NUTT, for a number of years with the Burlington system engaged principally in construction and maintenance work and as superintendent of various divisions, and later with the Michigan Central, the Northern Pacific, and the Los Angeles & Salt Lake R.R., has been elected president and general manager of the Monongahela Ry. He served in France during the world war in the railroad transportation corps, First Army, at Souilly. He was commissioned colonel in 1919 and upon receiving his discharge was appointed president of the coal commission for Central Europe at Mahrisch Ostrau, Czecho-Slovakia.

MONSARRAT & PRATLEY is a firm of consulting engineers organized by Lieutenant-Colonel C. N. Monsarrat and P. L. Pratley, with offices in Montreal, Que., to engage in the design and supervision of bridge work of all types, in concrete or steel, and for railway or highway purposes. The firm will also provide similar services in connection with foundations, piers, dams, and structural steel work for industrial and other buildings, and will undertake the preparation of reports and estimates, the making of inspections and appraisals and the furnishing of professional advisory services. Colonel Monsarrat was chairman and chief engineer of the Board of Engineers appointed to control and supervise the building of the Quebec Bridge, and since its completion, has been general consulting engineer to the Dominion Government. Mr. Pratley has had a wide experience in the construction of bridges and other structures throughout the Dominion.

R. D. STEWART has been appointed chief engineer of the Denver & Salt Lake R.R., with headquarters at Denver, Colo.

JOHN A. MCGREW, formerly superintendent of the Saratoga and Champlain divisions of the Delaware & Hudson Co., has been appointed superintendent of maintenance.

B. E. CLARK, recently acting state engineer of Oklahoma, has been appointed by Governor Robertson as acting state highway commissioner.

BAYARD A. LONG, formerly assistant sanitary engineer, has been appointed sanitary engineer of Johnstown, Pa., succeeding H. J. Baum, resigned.

OBITUARY

PRESTON K. YATES, consulting engineer, New York City, died in Albany, N. Y., April 22. He was born in Canajoharie, N. Y., in 1856 and was graduated from Rensselaer Polytechnic Institute in 1880. He was for many years associated with Alfred P. Boller on the construction of some of the important bridges in New York City and vicinity. From 1896 to 1900 he had charge of some of the large contracts on the metropolitan water-supply and sewerage systems in Massachusetts. He was for four years manager of a large Cleveland contracting firm engaged in building docks, breakwaters, dredging, etc. He had for a number of years specialized in the design and construction of crushed stone and gravel plants.

JOSEPH W. MOORE, assistant engineer, valuation department, Illinois Central and Yazoo & Mississippi Valley System, died April 13. He was born in Louisville, Ky., in 1874. He took a special three-year course in engineering at the University of Kentucky. From 1898 to 1907 he was in the employ of the engineering department of the Louisville & Nashville R.R. in both maintenance and construction. He also served as assistant in the valuation department of the Central of Georgia R.R. and later as roadmaster of the International & Great Northern Ry. at Navasota, Tex. From 1919 to the time of his death he was with the Illinois Central R.R. During the world war he was commissioned captain and assigned to Co. B, 35th Engineers. While in France he was in charge of maintenance of way and structures on the standard gage lines in the region of Verdun.

Hoover Plans Industrial Service Bureaus to Aid Commerce

Herbert Hoover, Secretary of Commerce, has asked Congress for supplemental appropriations aggregating $618,728 for the fiscal years 1921 and 1922, to be used in establishing in the Bureau of Foreign and Domestic Commerce twelve distinct divisions to furnish information regarding a number of industries, among them being cotton, paper, leather, chemicals, heavy machinery, machine tools, electrical goods, automobiles, lumber, metal products, vegetable oils, hardware, and jewelry. It is planned to have these divisions undertake commodity investigations in co-operation with the leading industries of the United States interested in foreign trade.

For an investigation of structural materials, to be conducted by the Bureau of Standards $50,000 has been asked. Secretary Hoover states that there is the most urgent need for the development of economical, durable, and safe buildings, especially homes, at reasonable cost. He believes the government, with a small outlay, can lead the way in improving construction by standardization of materials and formulation of building codes.

The matter of industrial waste elimination is regarded as important enough to justify the Bureau of Standards in expending an additional $100,000 for investigations in this field. Another of the more important items making up the supplemental appropriation is $100,000 for the standardization of equipment by the Bureau of Standards.

Building Conditions and Labor Supply in New York State

According to the labor market bulletin issued by the bureau of statistics and information of the New York State Industrial Commission, March reports from the ten first and second-class cities of the state indicate a 30 per cent increase in the value of authorized building work over February. The estimated cost of building operations for which permits were issued in March was $33,235,467, 4 per cent under that of March, 1920.

The ratio of total workers registered for employment to total workers called for was 169 to 100 in February, or exactly the same as in January. In March the ratio dropped to 145, thus indicating a downward tendency of unemployment in the state. The decrease in unemployment from February to March appears to be general, quotes the report. Nearly every city and occupation covered by the report showed a smaller ratio of workers looking for positions available in March than in February. The most pronounced reductions in the surplus of labor, continues the report, appear in agricultural work, building and construction, and manufacturing.

Tax Revisions Suggested by Secretary of Treasury

The repeal of the excess profits tax, readjustment of income tax rates, retention of certain of the miscellaneous specific sales taxes and excise taxes, but the repeal of others, and the imposition of new and additional taxes of wide application were the main suggestions made to the House Ways and Means Committee and the Senate Finance Committee May 1 by Secretary of the Treasury Mellon. The specific suggestions made by Secretary Mellon were:

1. Repeal of the excess profits tax, making good the loss of revenue by means of a

Labor Rates and Conditions Throughout the Country

UNCERTAINTY as regards wage schedules after May 1 in many territories has made it impossible in those territories to do more than publish the official scale in our monthly tabulation. Wherever possible we give the prevailing scale, whether official or otherwise. As example, for Minneapolis and Birmingham we carry the prevailing scales, although they depart from the union rate. The "official" Minneapolis scale expired on May 1, and the "current" rates are now supposed to prevail generally in that city.

We give the Kansas City rates as they stood on April 25, subject to change at an early date. The Detroit rates are vouched for by the Associated Building Contractors, though higher wages are being paid in some instances by certain contractors. Montreal reports that a reduction of from 10 to 25 per cent is expected this month.

The Boston strike continues, but contractors under open shop have plenty of help with the exception of bricklayers. In Denver conditions are unsettled, with some crafts accepting and other rejecting reductions, and some contractors holding out for the open shop while others are paying the old scale.

	Minneapolis		Birmingham	
	Current	Official	Open Shop	Union
Bricklayers	$1.00	$1.25	$0.85 to $1.00	$1.00
Carpenters	.80	1.00	.70 to .75	.875
Hoisting engineers	.80	1.00	....	....
Hod-carriers	.65	.75	.25 to .40	....
Iron workers	.80	1.00	1.00	1.00
Common labor	.50	.60	.20 to .25	....

S means scarce; E, enough; P, plentiful

Cities	Bricklayers	Carpenters	Hoisting Engineers	Hod Carriers	Pile Drivers	Structural Iron Workers	Common Labor
Atlanta	$0.90P	$0.70P	$1.00P	$0.30P	....	$1.00P	$0.25P
Baltimore	1.25	.80P	.87½P	.46@.54P	$0.74P	1.00P	.30@.35P
Birmingham	1.00	.87½	....	.25@.40	....	1.00	.20@.25
Boston	.90S	.90P	.90P	.60P	.90	.90P	.55P
Cincinnati	1.25P	1.00P	.70E	.85P	1.00E	1.25P	.35P
Chicago	1.25	1.25	....	....	....	1.25	1.00
Cleveland	1.25P	1.25P	1.25P	.87½P	1.10P	1.25P	.87½P
Dallas	1.00P	1.00P	1.00E	.60E	1.00E	1.00E	.50@.75P
Denver	1.37½	1.00	1.00	.75@.81¼	1.00	1.00	.37½@.50
Detroit	1.00P	.80P	.80@.90P	.50@.60P	1.00P	.60@.80P	.50P
Kansas City	1.12½	1.00	1.00	.90	1.10	1.10	.75
Los Angeles	1.25P	1.00P	1.00P	1.12½P	.94P	1.00P	.62½P
Minnespolis	1.00P	.80P	.80P	.65P	....	.80P	.50P
Montreal	.90P	.65P	.60P	.40P	.50P	.65P	.35P
New Orleans	1.00P	1.00P	1.00P	.65P	1.00P	1.00P	.50P
New York	1.25	1.12½	1.25	.87½	1.12½	1.12½	.75@.80
Pittsburgh	1.50P	1.25P	1.12½P	1.00P	1.00P	1.25P	.80P
St. Louis	1.25P	1.25P	1.25P	.85P	1.25P	1.25P	.67½P
San Francisco	1.25P	1.12½P	1.12½P	1.00P	1.12½P	1.12½P	.81¼P

modified tax on corporate profits, of a flat additional income tax on corporations and the repeal of the existing $2,000 exemption applicable to corporations.

2. Readjustment of the income tax rates to a maximum combined normal tax and surtax of 40 per cent for the taxable year 1921, and of about 33 per cent thereafter.

3. Retention of the miscellaneous specific sales taxes and excise taxes, including the transportation tax, the tobacco taxes, the tax on admissions, and the capital stock tax, but the repeal of the minor "nuisance" taxes, such as the taxes on fountain drinks and miscellaneous taxes levied under Section 904 of the Revenue Act.

4. The imposition of sufficient new or additional taxes of wide application, such as increased stamp taxes or a license tax on the use of automobiles.

5. The adoption of necessary administrative Amendments to the Revenue Act in order to simplify its administration and make it possible, among other things for the Commissioner of Internal Revenue, with the approval of the Secretary of the Treasury and the consent of the taxpayer, to make final determination and settlement of tax cases.

Lower Building Costs in England

(London Correspondence)

The fall in contract prices for the erection of dwellings of an average of £100 per house since last autumn is due to four main factors: (1) Lower cost of timber, oils, lead and tubes; (2) More skilled labor available and increasing output of bricklayers; (3) Lower profits asked by contractors; and (4) Improved organization among employers.

In some districts on the East Coast £200 less is being asked for erecting dwellings over the contract figures for the early part of the year.

On the other hand, a sectional committee appointed to investigate the position of light castings used in building, reports that the National Light Castings Association controls 95 per cent of the British output, and that the present output is enough for about 4,000 houses per month. The report also states that by the pooling arrangement adopted, members of the association have been penalized for increasing output while those who have reduced their output relative to the rest have been rewarded.

Marine Strike Follows Wage Cut

Resulting from the strike call issued by the Marine Engineers Beneficial Association April 25, to become effective May 1, following the breaking off of wage negotiations between union leaders and ship owners, American shipping has been tied up since May 1. The wage agreement between union leaders and ship owners ended May 1, and the marine engineers took the lead in refusing to consent to any decrease after that date. The proposal of the employers was for a reduction of from 20 to 30 per cent, though the order issued by Admiral Benson to all operators of government merchant craft was to reduce wages 15 per cent, effective May 1. The suggestion made by Secretary of Commerce Hoover that the dispute be arbitrated was flatly turned down by the ship owners. Ships are being deserted by their crews as soon as they reach port and the statement emphatically comes from both sides that there will be no compromise.

Chicago Plumbers and Sheet Metal Workers Indicted

Federal Indictments charging conspiracy in restraint of trade were returned last week against seventy-one Chicago corporations and thirty-nine individuals in the sheet metal, steamfitting and plumbing trades.

Past Week Sets New Record for Year in Building

Contracts let for the past week as reported in *Engineering News-Record* attained a record total for the year, the aggregate value being $31,742,483. The value of street and road contracts totalled $11,138,764 and that of miscellaneous buildings $13,528,918, both of which figures have been exceeded in past weeks. Federal government contracts were larger than usual, as were sewer contracts. The total contracts let during the past three weeks are in excess of $92,000,000 in value. The largest contract for the week was for the construction of a grain elevator in Brooklyn, N. Y., costing $1,500,000, for the New York State Barge Canal.

Income Tax Data Sought From Contractors

Because of the rather startling figures revealed in an analysis of the 1918 income-tax returns, showing the small percentage of general contractors who operate even at a reasonable profit, the Associated General Contractors of America is circularizing its membership in order to secure data on the 1920 returns. The idea back of the move is to have information at hand concerning contractors' incomes that will be of benefit in suggesting revisions to existing tax laws. Letters have been sent to 7,000 contractors asking for the same information as was included in their 1920 returns. The real name of the contractor submitting such figures is to be withheld, though a key or fictitious name is to be supplied so that corrections can be made when the completed list is compiled.

Monthly Prices of Construction Materials

Ups and Downs of the Market

Pig Iron—We quote the prices of the Matthew-Addy Co., although certain grades are obtainable under these quotations and producers of the steel-making grades will consider bids.

Railway Materials — Quotations on standard rails are the same as last month, but prices on light rails have been adjusted in Pittsburgh. Birmingham mill prices are included. Track supplies down in St. Louis. Track bolts are down in Pittsburgh and San Francisco.

Pipe—General decline on wrought pipe, as of basing card of April 13. Steel pipe is also down in the warehouses at New York, Chicago and St. Louis. Clay drain tile down in St. Louis. Sewer pipe down in New York, Boston, Detroit, and San Francisco, and up in St. Louis.

Road Oils and Asphalt—Business satisfactory in New York market with prices of road oils the same as last month, except that liquid asphalt is down ½c. per gal. Asphalt is down $1 per ton in bulk in New York. Sharp decrease on asphalt in Montreal. St. Louis reports sold out on asphalt for 1921.

Wood-Blocks—Down in New York. This month we show prices for Cincinnati and Kansas City.

Sand, Gravel and Stone—Very few changes in this market in any of the centers. Decrease in St. Louis but otherwise there is firmness.

Lime—Decreases in Boston, Montreal and Atlanta.

Cement—Now $2.90 delivered in New York against $3.10 last month, which allows only 4c. per bbl. profit to the dealer. Decreases in Detroit, St. Louis, Minneapolis, Dallas, Atlanta and Cincinnati. We now quote for Birmingham and Kansas City.

Steel Reinforcing—We show the reduced price at Pittsburgh, but have omitted the New York delivered price because keen competition has prevented stable quotations. New York prices are as low as the Pittsburgh-plus-freight price. Much the same situation obtains in the case of expanded metal lath in New York, but we are quoting prices about $4 lower than last month. Metal lath down also in Chicago, St. Louis and Dallas. There is a general reduction in concrete reinforcing bars.

Common Brick—Down in Chicago, New York, Dallas, Los Angeles, Boston, Cincinnati, and New Orleans.

Hollow Tile—Down in Chicago, Boston, Cincinnati, Denver, New Orleans, Detroit, Atlanta and Montreal.

Structural Shapes — Down in San Francisco. Quotations given for the first time on this item in Birmingham and Dallas. Rivets down in New York, Chicago and Dallas warehouses.

Lumber—The market appears generally to be steadier than was the case a month ago. No changes in Douglas fir in San Francisco or in pine in New York, Chicago, or St. Louis. We quote Birmingham prices for the first time and have resumed quotations at Kansas City.

Price advances since last month are indicated by **heavy type**; declines by *italics*

PIG IRON—Quotations compiled by The Matthew Addy Co.:

	Current	One Year Ago
CINCINNATI		
No. 2 Southern	$29.50	$45.60
Northern Basic	27.52	42.80
Southern Ohio No. 2	28.52	46.80
NEW YORK, tidewater delivery		
Southern No. 2 (silicon 2.25 to 2.75)	35.26	49.70
BIRMINGHAM		
No. 2 Foundry	$24.00	42.00
PHILADELPHIA		
Eastern Pa., No. 2X, 2.25@2.75 sil.	26.25@28.00*	45.65*
Virginia No. 2	28.00*	43.25*
Basic	25.25†	44.50†
Grey Forge	27.00*	43.50*
CHICAGO		
No. 2 Foundry Local	24.00	44.25
No. 2 Foundry Southern	32.92	47.00
PITTSBURGH, including freight charge from the Valley		
No. 2 Foundry Valley	26.96	45.65
Basic	26.86	44.40
Bessemer	27.25	44.90

*F.o.b. furnace. † Delivered.

RAILWAY SUPPLIES

STEEL RAILS—The following quotations are per ton f.o.b. Pittsburgh and Chicago for carload or larger lots. For less than carload lots 5c. per 100 lb. is charged extra:

	Pittsburgh			
	Current	One Year Ago	Birmingham	Chicago
Standard bessemer rails	$45.00	$45.00	.....	$45.00
Standard openhearth rails	47.00	47.00	$47.50	47.00
Light rails, 8 to 10 lb.	2.30*	3.75*	.....	2.45@3.00*
Light rails, 12 to 14 lb.	2.25*	3.75*	2.20*	2.41@2.95*
Light rails, 25 to 45 lb.	2.20*	3.75*	2.20*	2.32@2.85*

*Per 100 lb.

RAILWAY TIES—For fair-sized orders, the following prices per tie hold:

	6 In. x 8 In. by 8 Ft.	7 In. x 9 In. by 8 Ft. 6 In.
Chicago, White Oak	$1.60	$1.75
Chicago, Hardwood and Red Oak	1.40	1.55
Chicago....Empty Cell Creosoted	2.00	2.25
San Francisco..... Green Douglas Fir	.80	1.12
San Francisco, Empty Cell Creosoted, Douglas Fir	1.76	2.48

For ties on standard "railroad administration" specifications, f.o.b. cars, St. Louis:

	White Oak	Red Oak	Pine and Sap Cypress
Grade 3	$1.35	$1.20	$1.10
Grade 2	1.25	1.10	1.00
Grade 1	1.15	1.00	.90

TRACK SUPPLIES—The following prices are base per 100 lb. f.o.b. Pittsburgh for carload lots, together with the warehouse prices at the places named:

	Pittsburgh				San
	Current	One Year Ago	Chicago	St. Louis	Francisco
Standard spikes, ⅜-in. and larger	$3.30	$4.00	$3.40	$4.75	$5.86
Track bolts	4.35	6.00	4.60	5.60	6.81
Standard section angle bars	2.50	3.50	2.75	3.50	4.50

PIPE

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the Pittsburgh basing card of April 13, 1921:

BUTT WELD

Inches	Steel Black	Steel Galv.	Inches	Iron Black	Iron Galv.
1 to 3	62½	50	⅜	33½	18½
			½ to ¾	35½	20½

LAP WELD

2	54½	41	2	30½	16½
2½ to 6	58½	45	2½ to 4	34½	22½
7 to 12	54½	44	4½ to 6	33½	21½
13 and 14	45	37	7 to 8	24½	12½
15	42½	32	9 to 12	19½	7½

BUTT WELD, EXTRA STRONG, PLAIN ENDS

⅛ to 1¼	60½	49	⅜ to 1¼	35½	21½
2 to 3	61½	50			

LAP WELD, EXTRA STRONG, PLAIN ENDS

2	52½	41	2	31½	18½
2½ to 4	56½	45	2½ to 4	34½	22½
4½ to 6	55½	44	4½ to 6	33½	21½
7 to 8	50½	37	7 to 8	24½	12½
9 to 12	45½	32	9 to 12	19½	7½

STEEL—From warehouses at the places named the following discounts hold for steel pipe:

	Black		
	New York	Chicago	St. Louis
⅛ to 2½ in. butt welded	58%	62½%	50½%
3 to 6 in. lap welded	49%	58½%	46½%
	Galvanized		
	New York	Chicago	St. Louis
⅛ to 2½ in. butt welded	37%	50%	36½%
3 to 6 in. lap welded	35%	46%	32½%

Malleable fittings, Class B and C, from New York stock sell at *net* list prices. Cast iron, standard sizes, 20—5% off.

CAST-IRON PIPE—The following are prices per net ton for carload lots:

	New York				
	Current	One Year Ago	Birmingham	Chicago	San Francisco
4 in.	$73.30	$79.30	$60.00	$69.10	$90.90
6 in. and over	63.30	76.30	55.00	64.10	85.90

Gas pipe and Class "A," $4 per ton extra; 16-ft. lengths, $1 per ton.

CLAY DRAIN TILE—The following prices are per 1000 lin.ft.:

	New York					
Size, In.	Current	One Year Ago	St. Louis	Chicago	San Francisco	Dallas
3	$50.00	$35.00	$60.00	$50.00	.....	$55.00
4	60.00	51.00	60.00	70.00	$90.00	65.00
5	90.00	65.00	90.00	90.00	115.00	84.00
6	115.00	90.00	100.00	110.00	150.00	110.00
8	185.00	130.00	150.00	160.00	250.00	181.00

SEWER PIPE—The following prices are in cents per foot for carload lots:

Size, In	New York Delivered	Pittsburgh	Birmingham	St. Louis	Chicago	San Francisco	Dallas
3	$0.22	$0.132	.....	.....	$0.15	$0.13	.....
4	.22	132	$0.11	.....	15	1625	$0.18
5	.34	198	.....	.....	25	195	165
6	.34	198	$.165	182	225	2275	25
8	.52	308	.275	26	35	325	35
10	.78	462	.355	364	525	455	.....
12	1.00	594	.4675	.52	625	585	80
15	1.50	792	.6875	.81	.90	975	.....
18	2.18	1.10	.935	1.134	1.25	1.365	.....
20	2.66	1.32	1.2375	.....	1.50	.....	.....
22	3.50	1.98	.....	.....	2.00	.....	.....
24	3.50	.....	1.7875	1.944	2.25	2.34	2.40
27	.....	.....	.....	2.80	4.50	3.25	.....
30	.....	.....	4.00	3.55	5.50	3.90	.....
33	.....	.....	.....	4.35	6.75	.....	.....
36	.....	.....	.....	4.75	7.00	.....	.....
	3		5	8	12	24	36
Boston	$0.153		$0.23	$0.357	$0.688	$2.29	$5.95
Minneapolis	.....		.....	.42	.77	2.45	5.66
Denver	.....		.15	.30	.50	1.95	.....
Seattle	.....		.....	.40	.80	2.88	.....
Los Angeles	.11*		.165*	.27	.49	1.65	.....
New Orleans	37 per..ent off Southern list						
Cincinnati	.147		.2205	.343	.6615	2.205	6.15
Atlanta	.11*		.165*	.27	.4675	1.7875	.....
Montreal, *delivered*	.30*		.45*	.85*	1.35	4.50	6.50
Detroit	.138		.207	.322	.621	2.07	4.715
Baltimore	.....		.26	.41	.81	.266	.....
Baltimore, *delivered*	.....		.28	.44	.86	2.84	.....

*4-in., 6-in., 9-in., 30-in. respectively.

ROAD AND PAVING MATERIALS

ROAD OILS—Following are prices per gallon in tank cars 8,000 gal. minimum f.o.b. place named:

		Current	One Year Ago
New York, 45% asphalt	(at terminal)	$0.07	$0.13
New York, 65% asphalt	(at terminal)	.07	.13
New York, binder	(at terminal)	.07½	.13½
New York, flux	(at terminal)	.07	.14
New York, liquid asphalt	(atterminal)	.08	.10
St. Louis, 40-60% asphalt (*f.o.b.*) *Tulsa, Okla.*		.04*	.....
Chicago, 40-50% asphalt		.06	.08½
Chicago, 60-70% asphalt		.06½	.0725
Dallas, 40-50% asphalt		.10	.07
Dallas, 60-70% asphalt		.13	.08
Dallas, 75-90% asphalt		.15	.19
San Francisco, binder, per 42-gal. bbl.		15.00	2.25

* Freight $21.75 per ton to Whiting, Ind.

ASPHALT—Price per ton in packages (350-lb. bbl., or 425-lb. drums, and in bulk in carload lots:

	Package	Bulk
New York (Bayonne, N. J.)	$28.00	$17.00
Boston	No quotations	
Chicago	28 50	21 00
San Francisco	21 50	15 00
Dallas	35 00	27 00
Seattle	27 50	
Denver	....	50@70
Minneapolis	....	25 93
St. Louis	sold out for 1921	
Baltimore	40 00	
Los Angeles	23 75	15 00
Montreal	28 00	21 00
Atlanta	28 40	
Detroit (petroleum asphalt)	42 00	21 15
Cincinnati	35 50@50	29 50@44
Maurer, N. J. (asphalt)	27@38	....
Maurer, N. J. (asphalt cement)	29@36	25@31

PAVING STONE—

New York	5-in. granite		No quotations
Chicago	About 4x8x4 dressed		$3 40 sq.yd.
	About 4x8x4 common		3 05 sq.yd.
San Francisco	Basalt block 4x7x8		65 00 per M
Boston	5-in. granite		4 20 sq.yd.
Atlanta	Granite		2 00 sq.yd.
Detroit	Granite, 26½ blocks per sq.yd.		107 00 per M
Baltimore	Granite		2 25 sq.yd.
Montreal	Granite		6 50 sq.yd.
New Orleans	Granite		3 25 sq.yd.
Cincinnati	Granite		4 50 sq.yd.
St. Louis	Granite		3 40 sq.yd.
Kansas City	No. 1 Granite		4.00 sq.yd.

FLAGGING—

New York	Bronx	$0 25	sq.ft.
	Manhattan, 4 ft.	.26	sq.ft.
	Queens, 5 ft.	.26	sq.ft.
	6x20-in. cross-walk	1 00	lin.ft.
Chicago	18 in. wide	.70	lin.ft.

CURBING—Bluestone per lineal foot, in New York, costs 70c. for 5x16 in., 80c. for 5x18 in.; in carg lots.

WOOD BLOCK PAVING—

	Size of Block	Treatment	Per Sq.Yd.
New York	3½	16	$2.51
New York	4	16	2.78
Boston	3	16	3.45
Chicago	4	16	3 75@4.00
Chicago	3½	16	3 25@3 50
St. Louis	3½	16	3 05
St. Louis	4	16	3 50
Seattle	4	16	Off market
Minneapolis	3½	16	2 37
Atlanta	3½	16	2 30
New Orleans	3	16	2 99
New Orleans	3½	16	3 42
New Orleans	4	16	3 85
Dallas	4	18	3 90
Baltimore	3½	16	3 75
Montreal, *delivered*	4	16	130.00 per M.
Detroit	3½	16	3 40
Cincinnati	4	16	3 30
Kansas City	4	16	3 80

CONSTRUCTION MATERIALS

SAND AND GRAVEL—Price for cargo or carload lots is as follows, per cu.yd.:

	Gravel 1½ In.		Gravel ¾ In.		Sand	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
New York	$2.50	$2.50	$2.50	$2.50	$1.25	$1.50
Denver	2.00	1.80	1.80	1.80	1.60	1.40
Chicago	2.75	2.15	2.75	2.15	2.75	2.15
St. Louis	1.55	1.78	1.60	1.82	1.60	1.68
Seattle	1.50	1.25	1.50	1.25	1.50	1.25
Dallas, *delivered*	3.50	2.50	4.00	2.50	3.00	2.00
Minneapolis	2.00	1.50	....	1.35	1.00	.75
Cincinnati	2.56½	....	2.62½	1.55	1.95	1.50
San Francisco	2.50	1.50	2.50	1.50	1.65	1.50
Boston, per ton	2.65	2.85	2.65	2.85	2.00	2.00
New Orleans	2.85	3.00	....	....	1.65	1.40
Los Angeles, per ton	1.55	1.25	1.45	1.25	1.00	1.15
Atlanta, per ton	2.62½	2.25	....	2.25	1.52½	1.15
Detroit	2.50	2.50	2.50	2.00	2.50	1.85
Baltimore, per ton	1.40	1.40	1.60	1.60	.70	80
Montreal, per ton	1.50	1.15	1.75	....	1.50	1.40
Birmingham		3.25		3.75	1.43	1.25

CRUSHED STONE—Price for cargo or carload lots is as follows, per cu.yd.

	1½ In. Current	1½ In. One Year Ago	¾ In. Current	¾ In. One Year Ago
New York	$1.90@2.00	$1.90	$2.15	$2.15
Chicago	2.75	2.15	2.75	2.15
St. Louis *delivered*	2.60	1.90	2.60	1.65
Dallas *delivered*	2.80	3.50	2.80	3.50
San Francisco	2.50	1.50	2.50	1.50
Boston	3.00*(del)	3.00	3.00 (del)	3.25
Minneapolis	2.00	1.50	2.25	1.60
Kansas City	2.52	2.35	....	2.50
Denver	....	3.75	....	3.75
Seattle *delivered*	3.50	3.50	3.50	3.50
Atlanta	2.50*	3.10*	....	....
Cincinnati *delivered*	3.06¼	....	3.06¼	....
Los Angeles	1.75*	1.60	1.80*	1.50
Detroit	2.00*	1.75	2.00*	1.75
Baltimore	1.75*	1.50	1.75*	1.50
Montreal	2.00*	2.00	2.10*	2.00

* Per ton.

CRUSHED SLAG—Price of crushed slag per net ton in carload lots:

	1½-In.	¾-In.	Roofing	Sand
Lebanon or Bethlehem, Pa	$1.00	$1.00	$2.50	$0.90
Easton, Pa	1.20	1.20	3.00	1.10
Buffalo, N. Y.	1.25	1.00	2.00	1.00
East Canaan, Conn.	1.25	1.35	4.00	1.10
Birmingham, Ala.	1.25	1.25	2.05	1.00
Toledo, Ohio	1.50	1.50	2.35	....
Atlanta, Ga.	2.58	2.25	....	....

Birmingham, f.o.b. pit $1.15 (or $2.75 per cu. yd. on site)

LIME—Warehouse prices:

	Hydrated, per Ton Finished	Hydrated, per Ton Common	Lump, per 200-Lb. Barrel Finished	Lump, per 200-Lb. Barrel Common
New York	$21.00	$20.00	$3.50* - at plant	$3.30*
Chicago	20.00	....	....	1.75
St. Louis	26.00	20.00	....	2.50
Boston	27.25	22.75	3.65	3.40
Dallas	27.50	25.00	....	3.00†
Cincinnati	17.60	16.60	....	13.10‡
San Francisco	25.40	22.00	....	2.25
Minneapolis	29.00	22.00 (white)	2.00	1.70
Denver	....	3.20 (bbl.)	1.00 (bu.)	
Detroit	22.00	19.00	2.00†	1.80†
Seattle	27.00	....	3.25	....
Los Angeles	30.00	30.00	3.00*	3.00*
Baltimore	22.25	17.50	....	12.75‡
Montreal	30.00	....	15.00‡	....
Atlanta	....	15.00	....	1.25
New Orleans	....	22.50	....	2.25

* 300-lb. barrels. † Per 180-lb. barrel. ‡ Per ton.

NOTE—Refund of 10c per barrel.

NATURAL CEMENT—Price to dealers for 500 bbl. or over, f.o.b., exclusive of bags:

	Current	One Year Ago
Minneapolis (Rosedale)	$2.80	$1.50
Kansas City (Ft. Scott)	1.60	1.60
New Orleans	3.36	3.36
Atlanta (Magnolia)	11.00 ton	1.90
Cincinnati (Louisville)	2.75	2.85
Boston (Rosedale)	3.00	....

PORTLAND CEMENT—Current prices are for barrels in carload lots, *without* bags, to contractors:

	Current Without Bags	One Month Ago Without Bags	One Year Ago Without Bags
New York (delivered)	$2.90	$3.10	$3.20
New York, alongside dock to dealers	2.40	2.40	2.35
Jersey City (delivered)	2.89	2.64	2.67
Boston	2.86	2.87	2.62
Chicago	2.17	2.17	2.00
Pittsburgh	2.17	2.17	2.05
Cleveland	2.43	2.43	2.32
Detroit	2.43	2.51	2.35
Indianapolis	2.43	2.31	2.27
Toledo	2.49	2.51	2.12
Milwaukee	2.39	2.39	2.11
Duluth	2.10	2.10	2.10
Peoria	2.45	2.43	2.12
Cedar Rapids	2.51	2.51	2.18
Davenport	2.47	2.47	2.14
St. Louis	2.40	3.40	2.80
San Francisco	3.09	3.09	2.63
New Orleans	3.36	3.36	2.96
Minneapolis (delivered)	2.60	2.70	2.22
Denver	3.10	3.10	2.82
Seattle	3.10	3.10	3.03
Dallas	2.60	2.85	2.15
Atlanta	2.75	3.00	2.70
Cincinnati	2.62	2.87	2.90
Los Angeles	3.21	3.21	3.85
Baltimore (del.) drayload lots	3.58	2.58	....
Detroit	2.43	2.43	....
Birmingham	3.05	....	....
Kansas City	3.20	....	2.56
Montreal	3.44	3.44	3.48

NOTE—Bag charge is 10c. each

TRIANGLE MESH—Price per 100 sq.ft. in carload lots:

PLAIN 4-INCH by 4-INCH MESH

Style Number	Weight in Pounds	Pittsburgh, Mill	Chicago	Dallas	San Francisco
032	0.022	$0.87	$1.11	$1.15	$1.54
049	0.028	1.11	1.43	1.46	1.96
068	0.035	1.35	1.74	1.80	2.41
093	0.045	1.73	2.24	2.30	3.11
126	0.057	2.14	2.79	2.86	3.88
153	0.068	2.55	3.32	3.40	4.03
180	0.078	2.93	3.81	3.93	....
245	0.103	3.86	5.03	5.15	....
287	0.119	4.46	5.81	5.96	8.10
336	0.138	5.18	6.73	7.32	....
395	0.160	6.00	7.81	8.00	....
		PAVING			
036P	0.017	$0.66	$0.85	$0.88	....
053P	0.024	0.94	1.21	1.24	....
072P	0.031	1.18	1.53	1.57	....
097P	0.040	1.52	1.97	2.02	....
049R	0.024	0.94	1.21	1.24	....
067R	0.031	1.18	1.53	1.57	....
089R	0.040	1.52	1.97	2.02	....

Made in 16-, 20-, 24-, 28-, 32-, 36-, 40-, 44-, 48-, 52- and 56-in. width in rolls 150-, 200- and 300-ft. lengths. Galvanized is about 10% higher.

EXPANDED METAL LATH—Prices in carload lots per 100 yd. for painted are as follows:

Gage	Weight	New York Delivered	Chicago	St. Louis	San Francisco	Dallas
27	233	$25.00	$27.50	$29.35	$34.20	$31.55
26	250	26.00	28.90	29.35	.....	33.30
25	300	27.00	31.15	.....	.....	36.00
24	340	28.00	33.10	33.00	42.70	37.45
22	450	31.00	.....	.....	....	43.30

BARS, CONCRETE REINFORCING—Current quotations per 100 lb:

ROLLED FROM BILLETS

Inches	Pittsburgh Mill	New York	Birmingham Mill	Chicago	St. Louis	Dallas	San Francisco
		Warehouse, Uncut					
½ and larger	$2.10	$3.38	$2.35	$3.13	$3.22½	$3.75	$2.35
⅝ and larger	2.15	3.43	2.50	3.17	3.27½	3.80	2.40
¾ and larger	2.20	3.48	2.50	3.23	3.32½	3.85	2.45
⅞ and larger	2.35	3.53	2.50	3.38	3.47½	4.00	2.60
1 and larger	2.60	3.88	2.50	3.83	3.72½	4.45	2.85

*Includes 15c charge for cutting to lengths of 2 ft. and over.

Twisted bars cut to length take extra of 27½c. per 100 lb.

ROLLED FROM RAILS

	Chicago	St. Louis	Dallas		Chicago	St. Louis	Dallas
½ in. and larger	$2.50	$2.25	$4.25	½	$2.90	$2.50	$3.40
⅝	2.55	2.30	4.30	¾	2.90	2.75	3.45
⅞	2.65	2.35	....	1	....	....	3.50

BRICK—Contractors price per 1,000 in cargo or carload lots is as follows:

	Common Current	Common One Month Ago	Common One Year Ago	Paving Block 3-inch*	Paving Block 4-inch*
New York (del.)	$18.40	$21.70	$29.00	$47.25	$53.50
New York (at dock)	15.00	18.00	25.00	.....	.....
New Orleans	25.50	25.50	23.00	.....	.....
Chicago	12.00	15.00	14.00	34.00	.....
St. Louis, salmon	15.00†	15.00	16.00	.....	.....
Denver, salmon	14.00	14.00	17.00	.....	.....
Dallas	16.00	18.50	24.00	44.00	.....
San Francisco	18.00	18.00	15.00	.....	44.38
Los Angeles	15.00	15.50	13.50	(not used)	
Boston (del.)	21.75	25.00	30.00	49.25	57.25
Minneapolis (del.)	18@20	18.00	20.00	37.00	43.00
Kansas City	20.00	.....	22.00	.....	.....
Seattle	19.00	19.00	15.00	48.00	53.50
Cincinnati	20.00	21.00	24.00	43.00	.....
Montreal (del.)	18.00	18.00	17.50	100.00	120.00
Detroit	18.00	18.00	23.00	46.00	52.00
Baltimore (del.)	20@25	22.50	20.00	40.00‡	44.00‡
Atlanta	12.00	12.00	.....	.....	.....
New Orleans	17.50	21.50	.....	.....	.....

* For paving blocks 3½x8½x3 and 3½x8½x4 respectively. †Hard brick $20.50 in St. Louis. ‡ Vitrified, f.o.b. plant, Baltimore.

HOLLOW TILE—Price per block in carload lots for hollow building tile:

	New York Current on Trucks	New York One Year Ago	Chicago	St. Louis	San Francisco	Perth Amboy N. J., Factory
4x12x12	.....	$0.1895	$0.1095	....	$0.145	.....
6x12x12	.....	.2526	.1642	....	.21	.....
8x12x12	.....	.....	.1971	....	.29	.....
10x12x12	.....	.....	.2463	$0.223	.....	.....
12x12x12	.....	.....	.2956	.266	.....	.....

Note—Definite prices not decided upon in New York

	4x12x12	8x12x12	12x12x12
Boston	$0.1135	$0.2127	$0.2935
Minneapolis	.096	.168	.264
Minneapolis (delivered)	.104	.182	.286
Cincinnati	.089	.158	.203
Kansas City	.115	.207	...
Denver	.09	.16	.23
Seattle	13	.175	.30
Los Angeles	.11	.192	.23
New Orleans	.14	.25	.3750
Detroit	.1042	.1853	.2779
Montreal	.20	.30	.35
Baltimore	.16	.27	.45
Atlanta	.09875	.176	.....
Dallas	.13	....	....

STRUCTURAL MATERIAL—Following are base prices f.o.b. mill, Pittsburgh and Birmingham together with quotations per 100 lb. from warehouses at places named:

	Pittsburgh, Mill	New York (del.)	Birmingham	Dallas	St. Louis	Chicago (del.)	San Francisco
Beams, 3 to 15 in.	$2.20	$3.33	$2.20	$4.50	$3.32½	$3.23	$4.35
Channel, 3 to 15 in.	2.20	3.33	2.20	4.50	3.32½	3.23	4.35
Angles, 3 to 6 in., ¼ in. thick	2.20	3.33	2.20	4.50	3.32½	3.23	4.35
Tees, 3 in. and larger	2.20	3.33	2.20	4.50	3.32½	3.23	4.85
Plates	2.40	3.33	2.20	4.50	3.32½	3.23	....

RIVETS—The following quotations are per 100 lb.:

STRUCTURAL

	Pittsburgh, Mill	New York Current	New York One Yr. Ago	Warehouse Chicago	Warehouse St. Louis	Warehouse San Francisco	Warehouse Dallas
½ in. and larger	$3.70	$4.65	$6.00	$4.88	$4.97½	$7.05	$5.80

CONE HEAD BOILER

½ in. and larger	3.80	4.75	6.10	4.98	5.07½	7.15	5.90
⅝ and ¾	3.95	4.90	6.25	5.13	5.22½	7.40	6.05
⅞ and 1	4.20	5.15	6.60	5.48	5.47½	7.65	6.30

Lengths shorter than 1 in. take an extra of 50c. Lengths between 1 in. and 2 in. take an extra of 25c.

NAILS—The following quotations are per keg from warehouse:

	Pittsburgh, Mill	Chicago	San Francisco	Dallas	St. Louis	Montreal
Wire	$3.25	$4.15	$5.25	$5.00	$4.10	$4.95
Cut	....	7.65	....	7.75	4.75	5.00

PREPARED ROOFINGS—Standard grade rubbered surface, complete with nails and cement, costs per square as follows at manufacturing points:

	New York 1-Ply l.c.l.	New York 2-Ply l.c.l.	New York 3-Ply l.c.l.	Philadelphia 1-Ply l.c.l.	Philadelphia 2-Ply l.c.l.	Philadelphia 3-Ply l.c.l.
No. 1 grade	$2.15	$2.55	$3.00	$2.05	$2.45	$2.90
No. 2 grade	1.90	2.25	2.70	1.80	2.15	2.60

Slate-surfaced roofing (red and green) in rolls of 108 sq.ft. costs $2.80 per roll in carload lots and $3.05 for smaller quantities f.o.b. Philadelphia.

Shingles, red and green slate finish, cost $7.95 per square in carloads; $8.20 in smaller quantities, in Philadelphia.

ROOFING MATERIALS—Prices per ton f.o.b. New York:

Tar felt (14 lb. per square of 100 sq.ft.) per roll of 432 sq. ft	$2.80
Tar pitch (in 400-lb. bbl.) per 100 lb	2.10
Asphalt pitch (in barrels) per ton	49.50
Asphalt felt (light) per ton	98.00
Asphalt felt (heavy) per ton	102.00

SHEETS—Quotations are in cents per pound in various cities from warehouse also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	St. Louis	Chicago	San Francisco	New York
No. 10	$3.10	$4.22½	$4.13	$6.00	$4.25
No. 12	3.15	4.27½	4.18	6.05	4.30
No. 14	3.20	4.32½	4.23	6.10	4.35
No. 16	3.30	4.42½	4.33	6.20	4.45
Black					
*Nos. 18 and 20	3.85	5.30	5.20	6.80	4.95
*Nos. 22 and 24	3.90	5.35	5.25	6.85	5.00
*No. 26	3.95	5.40	5.30	6.90	5.05
*No. 28	4.00	5.50	5.40	7.00	5.38
Galvanized					
No. 10	4.00	5.50	5.70	.....	5.30
No. 12	4.10	5.60	5.80	7.10	5.40
No. 14	4.25	5.60	5.80	7.25	5.40
Nos. 17 to 21	4.40	5.90	6.10	7.40	5.70
Nos. 22 and 24	4.55	6.05	6.25	7.55	5.85
*Nos. 25 and 26	4.70	6.20	6.30	7.70	6.00
*No. 28	5.00	6.50	6.40	8.00	6.25

* For painted corrugated sheets add 30c. per 1000 lb. for 5 to 28 gage; 25c. for 19 to 24 gages; for galvanized corrugated sheets add 15c., all gages.

LINSEED OIL—These prices are per gallon:

	New York Current	New York One Year Ago	Chicago Current	Chicago One Year Ago
Raw in barrel (5 bbl.)	$0.67	$1.63	$0.68	$1.66

WHITE AND RED LEAD—Base price per pound:

	Red — Current		Red — 1 Year Ago		White — Current	White — 1 Yr. Ago
	Dry	In Oil	Dry	In Oil	Dry and In Oil	Dry and In Oil
100-lb. keg	13 00	14 50	15 50	17 00	13 00	15 50
25 and 50-lb. kegs	13 25	14 75	15 75	17 25	13 25	15 75
12½-lb. keg	13 50	15 00	16 00	17 50	13 50	16 00
5-lb. cans	16 00	17 50	18 50	20 00	16 00	18 50
1-lb. cans	18 00	19 50	20 50	22 00	18 00	20 50

500 lb. lots less 10% discount; 2000 lb. lots less 10–2½% discount.

LUMBER

San Francisco—Prices of rough Douglas fir No. 1 common, in more than carload lots:

	Lumber Prices in Yards at San Francisco — 6-8 and 12 Ft.	10-16-18 and 20 Ft.	22 and 24 Ft.	25 to 32 Ft.
3x3 and 4	$24 50	$25 00	$26 00	$28 00
3x6 and 8	25 50	26 00	27 05	29 00
4x4-6 and 8	26 00	27 00	28 00	29 50
3x10 and 12	26 00	27 00	28 00	30 00
3x14	26 50	27 50	28 50	30 50
4x10 and 12	26 00	27 00	28 00	30 00
4x14	27 00	28 00	29 00	31 00
	24 Ft. and Under		25 to 32 Ft.	33 to 40 Ft.
110	$25 50		$27 50	$28 50
6x14	27 00		29 00	29 50
8x10	25 50		27 50	28 50
3x14	27 00		29 00	29 50

New York, Chicago and St Louis

	Southern Pine — New York* — 20 Ft. and Under	22–24 Ft.	Chicago — 20 Ft. and Under	22-24 Ft.
3x 4 to 8x8	$37 00	$38 00	$51 00	$52 00
3x10 to 10x10	42 00	43 00	53 00	54 00
3x12 to 12x12	48 00	40 00	55 00	56 00
3x14 to 14x14	53 00	54 00	60 00	61 00
3x16 to 16x16	60 00	61 00	65 00	66 00
3x18 to 18x18	72 00	73 00	69 00	70 00
4x20 to 20x20	.....	.....	72 00	73 00

* For long leaf pine. Short leaf pine up to 14 x 14 costs $15 per M. less.

St. Louis: Yellow pine, 22@24 ft. long, 3 x 12@4 x 12, $42; 2 x 16, $53; 3 x 16 @4 x 16, $53; 6 x 10 to 10 x 10, $37; 6 x 12@12 x 12, $41; 6 x 14@14 x 14, $45; 6 x 16@16 x 16, $51.

Over 24 ft.—Add $1 for each additional 2 ft. in length up to 30 ft. for sizes 12x12 and under, for sizes over 12 x 12 add $2, for merchantable add $2 to sizes 10 x 10 and under. For pine add $2 to the price of merchantable for all sizes.

Other Cities

	8 x 8-In. x 20-Ft and Under — P.	Fir	Hemlock	Spruce	12 x 12-In. 20 Ft. and Under — P.	Fir
Boston	$45.00	$53.00	$55.00	$50.00	$55.00	$59.00
Seattle	.....	25 00	.....	.....	.....	27.00
New Orleans	35 00	.....	.....	.....	38 00	.....
Baltimore	60 00	.....	.....	.....	70 00	.....
Cincinnati	45 00	47 50	.....	.....	62 50	64.00
Montreal	78 00	85 00	68 00	78.00	78.00	100 00
Los Angeles	.....	47 00	46.00	.....	.....	49.00
Detroit	Quotations f.o.b mills only					
Denver	.....	37 25	.....	.....	.....	38 25
Minneapolis	47 00	41 00	34.00	.....	56.00	41.00
Atlanta	27 50	.....	.....	.....	40 00	.....
Dallas	45 00	.....	.....	.....	55 00	.....
Kansas City	33 00	33 00	.....	.....	38.00	.....

	1-In. Rough, 10 In. x 16 Ft. and Under — P.	Fir	Hemlock	2-In. T. and Gr. 10 In. x 16 Ft. — P.	Fir
Boston	$45 00	$53.00	$50 00	$53.00	$58.00
Seattle	.....	18.50	.....	.....	.....
New Orleans	55 00	.....	.....	35.00	.....
Baltimore	42 50@45	.....	.....	40@45	.....
Cincinnati	62 00	80 00	.....	35.00	.....
Montreal	120 00	60 00	60 00	80.00	80 00
Los Angeles	.....	41 00	40.00	.....	82.00
Denver	.....	31 25	.....	.....	29 25
Minneapolis	40 50	29 25	33.25	34.00	33 75
Atlanta	15 00	.....	.....	18 00	.....
Dallas	.....	30.00	.....	35.00	.....
Kansas City	44 00	32 00	32 00	31 00	34.00

* Montreal—Up to 32 ft.; over which, $3.00 per M. increase up to 30 ft.

Birmingham—Dimension and form lumber delivered on building site, $26@$28. For 8x8x20 and smaller, 85 per cent heart, $33; 12x12x20 and smaller, 85 per cent heart, $42; 1x10x16 and smaller, rough, $16; 2x10x16 t. and g., $22; f.o.b. mill.

FREIGHT RATES

On finished steel products in the Pittsburgh district, including plates, structural shapes, merchant steel, bars, pipe fittings, plain and galvanized wire nails, rivets, spikes, bolts, flat sheets (except planished), chains, etc., the following freight rates are effective in cents per 100 lb., in carloads of 36,000 lb.:

Baltimore	$0 33½	Detroit	$0 33
Birmingham	76½	Kansas City	81½
Boston	41½	New Orleans	51½
Buffalo	29½	New York	38
Chicago	38	Pacific Coast (all rail)	1.06½†
Cincinnati	33	Philadelphia	35
Cleveland	24	St. Louis	47½
Denver	1.35*	St. Paul	69½

Note—Add 3% transportation tax * Minimum carload, 40,000 lb. Minimum carload, 50,000 lb., structural steel only; 80,000 lb. for other iron or † eel products.

CONTRACTORS' SUPPLIES

STEEL SHEET PILING—The following price is base per 100 lb. f.o.b. Pittsburgh, with a comparison of a month and a year ago:

Current	One Month Ago	One Year Ago
$2.55	$2 55	$2.55@$3.65

WIRE ROPE—Discounts from list price on regular grades of bright and galvanized are as follows.

	New York
Hercules red strand, all constructions	20
Patent flattened strand, special and cast steel	20
Patent flattened strand, iron rope	5
Plow steel round strand rope	35
Special steel round strand rope	30
Cast steel round strand rope	22½
Iron strand and iron tiller	5
Galvanized iron rigging and guy rope	+12½%

San Francisco: Galvanized iron rigging and guy ropes +37½%; bright plow, 30% off.

Chicago: Plow steel, round strand, 30% off; flattened strand, 15%; cast steel round strand, 17½%.

Western and California territory, 30% plow steel; +17½% galvanized iron rigging and guy rope.

Montana, Idaho and Arizona, 25% plow steel; +22½% galvanized iron rigging and guy rope.

MANILA ROPE—For rope smaller than ¾-in. the price is ½ to 2c. extra; while for quantities amounting to less than 600 ft. there is an extra charge of 1c. The number of feet per pound for the various sizes is as follows: ¾-in., 8 ft.; ¾-in., 6; ¾-in., 4½; 1-in., 3½; 1¼-in., 2 ft. 10 in.; 1½-in., 2 ft. 4 in. Following is price per pound for ¾-in. and larger, in 1200-ft. coils:

Boston	$0 22½	New Orleans	.20½
New York	.18½	Los Angeles	.18½
Chicago	.21½	Seattle	.20
Minneapolis	.23	St. Louis	.21
San Francisco	.19	Montreal	.30
Atlanta	.23	Detroit	.21
Denver	.23	Baltimore	.25
Cincinnati	.22	Kansas City	.20½
Dallas	$0 29		

*780-ft. coils.

EXPLOSIVES—Price per pound of dynamite in small lots and price per 25 lb keg of black powder.

	Low Freezing 20%	Gelatin 40%	Gelatin 60%	80%	Black Powder
New York	.....	$0 22½	$0.36½	.....	.....
Boston	.225	.2475	.2825	$0.365	.....
Kansas City	.1675	.2025	.2375	.28	$2.20
Seattle	.1825	.2025	.2275	.2953	2.60
Chicago	.2225	.2425	.2675	.335	2.50
Minneapolis	.2222	.2426	.2682	.....	2.80
St. Louis	.245	.28	.315	.3575	2 50
Denver	.2250	.2550	.29	.3325	2.70
Dallas	.265*	29	375	.....	2 90
Los Angeles	.22	.27	.32	.....	3 10
Atlanta	.2525	.2875†	.3225	.3650	2 60
Baltimore	.2525	.2875	.3175	.36	2 10
Cincinnati	.2425	.....	.....	.....	2.65
Montreal	.30	.32	.37	.38	4 10
New Orleans	.255	.275†	.300†	.....	2 80
Birmingham, *delivered*	.1575	.1925	.2275	.27	2 10

* 30 Per Cent. † Low freezing.

PILES—For spruce and plain pine piles, delivered New York, the price is as follows:

Spruce 10-in. butts, 5-in. tops, length 20-30 ft.	$11 50
Spruce 12-in. butts, 6-in. tops, length 30-40 ft.	10 50
Pine 12-in. butts, 6-in. tops, length 41-50 ft.	13 75
Pine 14-in. butts, 6-in. tops, length 51-60 ft.	22 50
Pine 14-in. butts, 6-in. tops, length 61-71 ft.	25 25

	Dallas		St. Louis
6-in. x 20-ft	$4.60	6-in. x 30-ft	$7 90
		7-in. x 30-ft	10 10
6-in. x 30-ft	7 10	7-in. x 35-ft	15 55
		8-in. x 35-ft	16 55
8-in. x 30-ft	8 45	7-in. x 40-ft	16 05
		8-in. x 45-ft	27 05
8-in. x 35-ft	10 38	8-in. x 50-ft	28.05

OLD MATERIAL—The prices following are per gross ton paid to dealers and producers in New York. In Chicago and St. Louis the quotations are per net ton and cover delivery at the buyer's works, including freight transfer charges.

	New York	Chicago	St. Louis
No. 1 railroad wrought	$10.50	$10.25	$11.00
Stove plate	10.50	13.00	11 50
No. 1 machinery cast	17.50	13.75	15 00
Machine shop turnings	5.50	5.50	5 00
Cast boring	4.25	7.00	7 00
Railroad malleable cast	8.50	12.00	12.50
Re-rolling rails	10.00	13.00	.....
Relaying rails	41.00	35.00	.....

SHIP SPIKES—Current prices per 100 lb.

In.	San Francisco — Galv.	Black	Seattle Black
½	$9.20	$8.50	$8 55
⅝	8.75	6.75	8 25
¾	8.60	6 60	8 30

Pittsburgh base, $3.50@$3.60 per 100 lb.